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FLOOD INSURANCE STUDY

CITY OF CORPUS CHRISTI, TEXAS
NUECES AND KLEBERG COUNTIES

REVISED
AUGUST 3, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 485464

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF CORPUS CHRISTI, NUECES AND KLEBERG COUNTIES, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Corpus Christi, Nueces and Kleberg Counties, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study represent a revision of the original analyses prepared by Espey, Huston & Associates, Inc. (the study contractor), for the Federal Emergency Management Agency (FEMA) under Contract No. 4786. The work for the original study was completed in August 1983. This revision incorporates updated hydraulic analyses and updated topographic information on Oso Bay Tributary No. 2. The work was performed by Ogletree Engineering, Inc., and was completed in May 1988.

1.3 Coordination

A meeting held in Corpus Christi on May 2, 1978, was attended by officials of the City of Corpus Christi, a representative of FEMA, and a representative of Espey, Huston & Associates, Inc. The meeting was held to explain the nature and purpose of the study, the scope and limits of the work, and to obtain any available flood information relevant to the study.

The U. S. Geological Survey (USGS) district office in San Antonio was contacted on the availability of stream gaging stations within the study area. There are no stream gaging stations located on either stream selected for study.

The U. S. Army Corps of Engineers (COE), Hydrology Division Office in Galveston, Texas, and the Texas Department of Water Resources in Austin, Texas, were contacted to provide available flood information pertinent to the city; however, no flood data applicable to the study area was found other than the October 31, 1975 Flood Insurance Study (Reference 1).

The Texas Highway Department in Austin and the Soil Conservation Service (SCS) in Victoria and Temple, Texas, were contacted to provide available information on flood control measures within the study area. All information pertinent to the study is included in this report.

On January 26, 1984, the results of the original study were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Corpus Christi, Nueces and Kleberg Counties, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The study analysis includes coastline flooding due to hurricane-induced storm surge. Both the open coast and its inland propagation were studied; in addition, the added effects of wave heights were also considered. For streams affected by both riverine and tidal flooding, combined probability analysis was conducted to arrive at elevations created by flood occurrences caused by both types of flooding.

Streams studied by detailed methods are as follows:

Stream	Limits of Detailed Study
Airport Drainage Ditch	From confluence of Drainage Creek to approximately 1,040 feet above Joe Mireur Road;
Drainage Creek	From confluence with Oso Creek Tributary No. 10 to the Texas Mexican Railway;
Turning Basin Tributary	From Harbor Street to approximately 1,300 feet above West Broadway;

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

Stream	Limits of Detailed Study
Oso Bay Tributary No. 2	From approximately 1,500 feet below corporate limits to approximately 50 feet above Wooldridge Road;
Oso Bay Tributary No. 3	From confluence with Oso Bay to Rodd Field Road;
Oso Creek Tributary No. 6	From corporate limits to U. S. Government Railroad;
Oso Creek Tributary No. 10	From corporate limits to approximately 0.7 mile above Clarkwood Road;
Navigation Boulevard Drainage Ditch	From approximately 1,800 feet below Old Brownsville Road to Old Brownsville Road;
State Highway 44 East Drainage Ditch	From confluence with Drainage Creek to approximately 1,720 feet above Hopkins Road;
State Highway 44 West Drainage Ditch	From confluence with Drainage Creek to approximately 1,330 feet above Bronco Road;
Nueces River	From approximately 200 feet below Missouri Pacific Railroad to approximately 4.3 miles above Calallen Dam.

In this revision, the entire reach of detailed study for Oso Bay Tributary No. 2 has been restudied to reflect an updated hydraulic analysis conducted to incorporate a channelization project and the addition of a bridge.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through December 1983.

2.2 Community Description

The City of Corpus Christi, seat of government for Nueces County, is the largest incorporated area in the 13-county Coastal Bend Region of South Texas. A port site for almost 500 years, the community's location on the sheltered southern side of Corpus Christi Bay has contributed to its emergence from a frontier trading post to a nationally prominent deepwater port, second only to Houston in tonnage in 1973. Surrounded by estuarine bays, Corpus Christi first developed around the arounds of higher ground on the peninsula

which divides Nueces Bay to the northwest from Corpus Christi Bay to the north. A causeway, U. S. Route 181, now spans this neck of water to link Corpus Christi with the City of Portland five miles to the northeast. Total area within the present corporate limits of the city is approximately 1,526 square miles.

The City of Corpus Christi is bordered by San Patricio County to the north; the City of Aransas Pass, the City of Port Aransas, and Aransas County to the northeast and east; Kleberg County to the south; and the unincorporated areas of Nueces County to the southwest and west.

Cayo del Oso, into which Oso Creek empties, is an inland body of water covering about ten square miles, with outfall into Corpus Christi Bay at the foot of Ocean Drive to the east of Corpus Christi central business district. Cayo del Oso separates the Encinal Peninsula from the northern tip of Padre Island, one of the chain of barrier islands which line the Texas Coast. Thus, the City of Corpus Christi is surrounded by estuarine-type bays while being somewhat protected from the open ocean by an island barrier. A lengthy beach, approximately 17 miles long and fronting on Corpus Christi Bay, is the community's most prominent feature. Development has occurred within a narrow 5- or 6-mile band behind the beachfront seawall to take advantage of this valuable resource.

Spanish, Portuguese, French, and English seafarers have alternated in making port in Corpus Christi Bay and visiting the coastal islands since the early 1500s. Alvarez Alonzo de Peneda first recorded his discovery of the blue waters of Corpus Christi Bay in 1519. The present City of Corpus Christi began as a trading post in 1838. This small settlement, first known as Kinney's Trading Post or Kinney's Ranch, took its name from the adventurer and colonizer-impressario Colonel Henry Laurence Kinney, who founded the site. The outpost remained obscure and lawless until July 1845 when U. S. troops under General Zachery Taylor landed men, horses, and equipment at the beginning of the Mexico War to prepare for his subsequent expedition southward.

Texas joined the Union in 1845, and Nueces County was formed in 1847, with the City of Corpus Christi as the county seat. Corpus Christi was formally incorporated in 1926 as a home-rule city and adopted the present Commission-City Manager form of government in 1945.

Enterprise in the community has centered around its commercial potential as a coastal deepwater port since at least 1848, when steamship service was first instituted with New Orleans. The modern Port of Corpus Christi was formally opened on September 14, 1926. The first gas well, which proved to be uncontrollable by the technology then available, was brought in on White Point, on the north shore of Nueces Bay, on September 14, 1913, and Corpus Christi's career as a major petrochemical center of the United States began.

Today, more than 20,000 producing wells in approximately 700 oil and gas fields ring the community within a three-hour drive of the city limits.

Of the 433,822 people living in the 13-county Coastal Bend Region in 1970, 204,525, or 47 percent, were residents of Corpus Christi, according to U. S. Census Bureau statistics. By 1975, the city population had expanded by another 5 percent to 214,838. Official census statistics indicated an 18-percent increase by 1970 from the 1960 census figure of 167,090. Years of greatest population influx, however, were from 1940 to 1960, with an increase of 47 percent over the 1940 figure of 57,301 to 108,287 in 1950. The decade of the 1950s showed a 34-percent population increase as well (Reference 2).

A major deepwater port as well as the center of the petrochemical, manufacturing, and tourist industries in the Coastal Bend Region, Corpus Christi's economic growth has been steady in the past 50 years. The Municipal Growth Index, a composite based on indication such as commercial cash flows and requests for new utility services, indicates a continued growth rate in Corpus Christi of between 5 to 8 percent annually. On a 60-percent basis of assessment, the assessed evaluation of all taxable property in Corpus Christi in 1976 was $1,100,993,894. Over 55 million dollars in building permits were issued in Corpus Christi in 1976 alone and bank debits increased by 12 percent from 1975 to 1976. Over 4,400 businesses in the city are credit rated by Dun and Bradstreet (Reference 3). Corpus Christi is the cultural center of the Coastal Bend Region as well. The city maintains a symphony orchestra and a ballet company as well as several public museums. Texas Arts and Industries University and Del Mar College are centers of higher education.

The topographic relief of the City of Corpus Christi is substantial in some areas relative to its incorporated acreage and location along the coast. The natural land surface is very flat in most areas, with steep bluffs along Nueces Bay, Corpus Christi Bay, and Oso Creek. The differences in topography surface and immediate subsurface soils and groundwater conditions between the downtown business district near the Ship Channel and the eastern sections of the city near the Cayo del Oso are marked. Elevations range from a maximum of 75 feet mean sea level (msl) in the northwestern portions of the city along U. S. Route 77, to less than 15 feet msl along the beachfronts. In some areas, this variation in elevation results in a slope of as much as 12 feet per mile. Existing slopes of drainage into the Nueces River and Nueces Bay are generally relatively steep in comparison to other areas of the city and flow velocities may exceed 10 feet/sec in the larger channels. Isolated pockets of extremely low land, containing several hundred acres each, are scattered throughout the center of the city. Although most of these low areas lack natural outfall drainage, much of this land has been heavily developed already.

The City of Corpus Christi is located on what is known as the Marsh Belt of the Great Coastal Gulf Prairie. Predominant natural vegetation is seashore salt grass, changing to a mixture of short prairie grasses such as Andropogon, Paspalum, and Panicum within a mile of the beachfront, although these species have nearly disappeared under intensive agricultural cultivation.

Within the city limits, the soil is moderately permeable fine Galveston sand along the waterfronts, shading to heavy sandy loams within a mile of the waterfront in most areas. In sandy locations, the surface is moderately permeable with a percolation rate of 2 to 20 inches/hour, depending on elevation. The water table, however, is very shallow, within a few inches of the surface along the shoreline, and limits the ability of the soil to absorb runoff which has ponded in low places. The topsoil shades to black clay with a relatively high organic content in the southern portion of the city. The loamy clay areas have yellow clayey subsurface layers, a high shrink-swell capacity, and are very slowly permeable, from 0.1 to 0.2 inches/hour. Sand is generally encountered at depths of 10 to 15 feet under these clays; however, this varies from point to point. Because of this layered soil structure, the bluffs along Corpus Christi Bay, Nueces Bay, and Oso Creek have been preserved from erosion (Reference 4).

Climatological conditions in the community are heavily dependent on marine conditions. Summers are warm, winters are mild, and the humidity is generally high year round. U. S. Weather Bureau statistics have been kept in Corpus Christi, the official recording station for Nueces County, for the past 88 years. The mean maximum temperature, recorded in July, is 94 degrees Fahrenheit (^{o}F). The mean minimum temperature, recorded in January, is 47 ^{o}F. Average annual precipitation is measured at 28.53 inches, although rainfall totals in individual years may vary widely due to the passage of intermittent tropical storms. These storms are the most significant meteorological event of the area and potentially the cause of the most severe flooding along the Gulf Coast. May and August are months with total average rainfalls total, averaging 4.9 inches. The driest month is usually March, with only 1.1 inches tota'. Maximum total rainfall recorded in a 24-hour period was 8.76 inches which fell in September 1967, during the passage onshore of Hurricane Beulah (Reference 5).

2.3 Principal Flood Problems

The City of Corpus Christi, located on the edge of a coastal body of water, is subject to both coastal and riverine flooding. Precipitation comes either through brief but very intense local rainstorms or in long-duration periods of high total precipitation in association with tropical storms.

Riverine flooding results when rivers, streams, and creeks exceed their carrying capacity and overflow their banks, spilling onto adjacent land. Riverine flooding in the Corpus Christi area is usually localized, while coastal flooding is more widespread and is associated with higher economic losses. The most serious flooding conditions occur when storm surge tides combine with riverine overbank flooding as the result of torrential rains over a wide area of the coast.

Drainage patterns in the city vary according to locale. Before extensive development altered natural drainage basins in many areas of the city, major rainfalls resulted in runoff in broad, shallow, relatively unconfined channels. Much of the area drained very slowly and ponding was widespread. Only evaporation and infiltration over an extended period of time removed this ponded water.

As the City of Corpus Christi grew, this natural pattern of shallow overland flow, ponding, and resultant evaporation and infiltration became less and less acceptable as a system of stormwater removal.

The natural drainage of the most heavily developed areas of the city is primarily directed into Corpus Christi Bay, with a small amount into the Ship Channel and Nueces Bay and a small amount into the Cayo del Oso.

Padre Island Drive runs east to west through the city and forms the dividing line between the areas of older and more recent urban development. In the areas north and northeast of Padre Island Drive, the existing underground storm sewers generally drain north into Corpus Christi Bay. The areas south of Padre Island Drive which are served both by underground storm sewers as well as open drainage ditches, discharge into Oso Creek to the south. Oso Creek, however, outfalls into Cayo del Oso in the far eastern part of the city, which ultimately drains into Corpus Christi Bay.

The natural drainage pattern in the area north of Padre Island Drive is actually away from the shoreline, since the land elevation rises slightly on the bay front, causing surface runoff to flow southward. This condition has been solved by the use of a reverse slope in the design of existing underground storm sewers, permitting discharge into the bay. The elevated shoreline, rising to a small bluff near the western end of the seawall, is a particular problem in the downtown area (between the Flour Bluff and T-Head area). This section frequently experiences high levels of ponded runoff, and pumps must be used to force the water over the rise and into the bay.

The natural drainage pattern for the areas of Corpus Christi south of Padre Island Drive is into Oso Creek, which currently receives stormwater discharge at several points from drainageways serving developments along the south and southeastern portions of the city as well as overland sheet flow during heavy rainfall events from agricultural areas within the drainage basin of this waterway.

On the west side of the city, the major drainage divide is generally parallel to the alignment of Leopard Street but may vary as much as one mile south at some points. The area to the north drains into the Nueces River with outfall into Nueces Bay, and the area to the south drains into the headwaters of Oso Creek. Existing slopes of drainage into the Nueces River and Nueces Bay are generally relatively steep in comparison to other sections of the city. Flow velocities may exceed 10 feet/sec in the larger channels. The area along the drainage divide between the Nueces River and Oso Creek is quite flat. Local drainage problems and interbasin flow occur due to poorly defined natural drainage patterns and insufficient slope. The Oso Creek drainage basin generally slopes to the south and southeast at a very gentle rate. The existing natural drainage basins are quite broad. Peak runoff rates characteristically flood lateral areas along these drainageways.

In the Four Bluff area, the major drainage divide runs southwest to northeast along the approximate center of the peninsula. Areas to the north and west are in the Cayo del Oso drainage basin and areas to the south and east drain into Laguna Madre. Surface soils are very fine, uniformly graded sands underlain by clay at varying depths. A heavy marine clay is encountered at sea level along the Laguna Madre shore. Naturally ponded areas are characteristic of the Four Bluff area. These ponded areas usually indicate a bowl-like clay structure, either partially or fully overlain by sand. Although considerable gas and oil production has already occurred in the local field, no active faults or subsidence are currently known to exist on this peninsula.

Loss of elevation as the result of land subsidence within the city limits of Corpus Christi further compounds the drainage situation in the community. This subsidence is active at the present time and the present rate appears to be the greatest recorded. That area of active subsidence which cuts diagonally from southwest to northeast between the new International Airport and Clarkwood is clearly evident on contour maps and has occurred since 1938. The present area extends from approximately one mile south of State Highway 44 to north of State Highway 9 and from 0.5 mile west of Clarkwood to within approximately 0.25 mile of the airport on the east. Further settling in this area logically can be predicted to occur in the near future and must be taken into consideration in the initial design of any further drainage facilities in the area.

Coastal flooding occurs when the natural forces of wind, tide, and rain combine to force sea water above normal high tide lines and onto low-lying coastal areas. The storm surge tide which accompanies tropical storms and hurricanes is particularly severe along the Gulf Coast because of the shallowness of the coastal shelf, imperiling even those communities sheltered behind the coastal barrier islands.

When a hurricane eye funnels its water-push into a major river mouth, bay, or estuary, the storm creates a "tidal bore" which piles the seawater even more quickly and to higher elevations than a storm surge against a straight coastline.

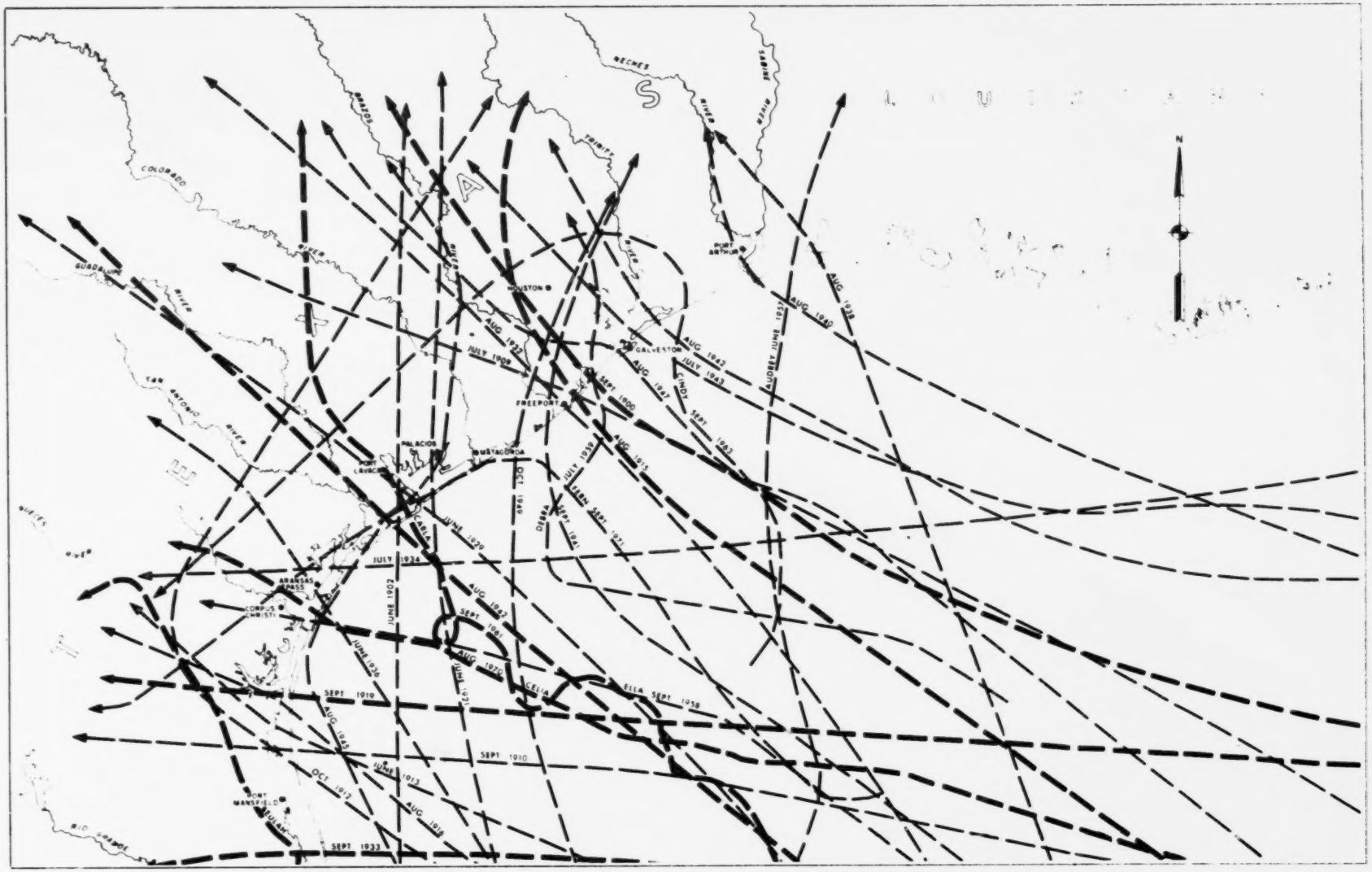
Historical descriptions of past hurricanes and related damage are plentiful for this area. Figure 2, "Historical Storm Tracks (1900-1971)" shows the tracks of some of the more significant storms to enter the Gulf of Mexico since 1900. Descriptions of the most significant storms follow.

1919 Storm (2-15 September). This storm was first noticed in the tropical storm stage in the extreme eastern portion of the Caribbean Sea. It was moving in a generally northwesterly direction toward the eastern portion of the Dominican Republic. From there it moved into the Atlantic Ocean before turning to a more westerly course, passing between the tip of Florida and Cuba, and entered the Gulf on a generally westerly course before striking the Texas coast in the vicinity of Baffin Bay. The eye of the storm moved inland over Kingsville and then turned west-northwestward towards Laredo.

Prior to Hurricane Carla (1961), the 1919 storm was considered the largest known hurricane to strike the Texas coast. Based on observations from various locations along the coast, the 1919 storm mass had an unusually large diameter as did Carla. Inadequate data for the 1919 storm prevents conclusive comparisons between the big storms.

Maximum sustained wind velocity recorded at Corpus Christi was 80 miles per hour. Surge elevations of up to sixteen feet were recorded as the storm surge swept across the barrier islands and through the passes, piling water upon the landward shores of Corpus Christi and Nueces Bays. Highest recorded surge elevations along the coast were approximately 11.1 feet. Surges of 6.6 feet or greater were experienced along almost the entire Texas coast.

The Town of Port Aransas on the north end of Mustang Island was entirely destroyed. The Corpus Christi Beach, or North Beach as it was known, was swept clean of all but three badly battered buildings. A section of Corpus Christi located below the 35-foot high bluff and having ground elevations ranging from four to seven feet was almost totally destroyed. This area was about three blocks wide and ten blocks long and contained warehouses, business, hotels, the electric power and light plant, two ice plants, and many residences. All of the development was totally destroyed except two one-story brick buildings, the upper floor and power plant of the six-story Nueces Hotel, and some machinery of the city power and light plant. The storm left 350 persons dead, and the damages exceeded $20 million.



FEDERAL EMERGENCY MANAGEMENT AGENCY

FIGURE 2

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

HISTORICAL STORM TRACKS (1900-1971)

1945 Storm (24-29 August). This storm originated in the Gulf of Mexico off the southern Mexican coast on August 24. The storm moved in a northerly direction to within about forty miles of Port Isabel by August 25 and continued northward, skirting the Texas coast before moving inland in the vicinity of San Jose Island on the morning of August 26. The storm continued to move northeastward along the coastal area, across Matagorda Bay, and then towards Bay City.

The storm was unusual in the coastal path it maintained, thereby raking essentially the entire Texas coast, and also because of its slow forward movement, traveling at less than five miles per hour. The area between Port Aransas and the mouth of the Colorado River received the maximum force of the hurricane.

The maximum storm surge varied considerably along the coast with about three feet recorded at Port Isabel, 3.7 feet at Port Aransas, 3.2 feet at Corpus Christi, 6.6 feet at Olivia, eight feet at Port O'Connor, 14.5 feet at Port Lavaca, and seven feet at Palacios. Maximum wind velocities were estimated at 76 mph at Port Isabel, 100 to 125 mph at Port Aransas, 85 mph at Palacios, and 135 mph at Seadrift, Olivia, Port O'Connor, and Port Lavaca.

The storm killed three people, injured 25, and caused damages exceeding $20 million.

Hurricane Celia (30 July-5 August 1970). Celia originated as a tropical depression in the northwestern Caribbean Sea on 30 July. The depression developed into a hurricane on August 1 after entering the Gulf of Mexico. The relatively small storm mass moved moderately fast and erratically across the Gulf toward the Texas coast. Celia lost strength on the morning of August 3 as the storm rapidly increased in size, but as Celia neared the coast, the eye of the storm became smaller and more concentrated and the wind speeds increased. When Celia was located about thirty miles east-southeast of Corpus Christi, the storm had regained strength with highest winds estimated at 115 miles per hour. The storm continued to intensify as it moved inland across Mustang Island and into Corpus Christi Bay at a forward speed of 17 mph. The anemometer at the weather station in Aransas Pass was blown away after measuring wind gusts of 150 miles per hour. Subsequent peak gusts were estimated to have reached 180 miles per hour. Maximum gusts of 160 mph were recorded at the Corpus Christi National Weather Service Office.

The metropolitan area of Corpus Christi, the Cities of Robstown, Port Aransas, and Aransas Pass, and the small towns along Corpus Christi Bay suffered the most damage. Although considerable damage resulted from storm surge, the majority of the destruction resulted from high winds. A surge of 9.2 feet was recorded on the Gulf Beach at Port Aransas, and a surge of 11.4 feet was recorded on the south side of Aransas Pass. At Corpus Christi, the stillwater surge elevation ranged from 3.9 to 5.6 feet.

Celia was the costliest storm in the state's history, having caused an estimated total damage of $470 million. Wind damage accounted for $440 million of this total. There were 13 people killed and over 450 injured. More than 9,000 homes were destroyed, 14,000 others damaged, and 250 businesses and 300 farm buildings were damaged or destroyed.

2.4 Flood Protection Measures

The continued growth of the City of Corpus Christi has been predicated on an active program of stormwater abatement throughout the history of the community's development. In addition to the construction of an approximately 3-mile seawall along the northern bayfront to reduce the threat of tidal surge in urban areas, a structure which was completed in 1940, Corpus Christi also has installed an extensive system of underground storm sewers and pumps to facilitate the removal of urban runoff. A street system of curb and gutter drainage serves most of the downtown business district and many of the residential areas of the city. Most of the residential area drainage laterals have been sized to accommodate a 5-year storm while the main trunk lines are sized to carry runoff from a 25-year storm. Streets laid out in newer subdivisions have been cut below grade to function as temporary conduits during periods of intense rainfall.

Broad channels have been constructed as well to serve as primary collection systems for stormwater in many of the newer residential developments. These "greenbelt" waterways also provide additional open space and recreational areas when they are not serving their primary function as floodways.

Some of the older sections of the central urban area of the City of Corpus Christi still rely on open shallow ditches along the roadsides for primary drainage. Other suburban areas, many of which were considered to be outlying or rural areas ten years ago before rapid urban expansion brought them within the city limits, are still served by an open roadside ditch system.

Severe erosion has occurred along these ditches where vegetative cover has been removed and the channel banks have remained unprotected. This is especially true in areas where channels have been incised so deeply as to cut into the sandy layers underlying the superficial clays. In some cases, adjacent properties are in danger due to excessively high rates of erosion in nearby drainage channels.

In the study area, land currently developed or in the process of imminent development tends to be concentrated in the upper ends of the drainage basins. Four drainageways have been excavated to the west of Corpus Christi in the Oso Creek drainage basin, with the City of Robstown the main beneficiary. Other ditches have been

excavated along Clarkwood and McKenzie Roads to remove encroaching salt water. These ditches are of insufficient size and depth to handle current volumes of flow and are undesirably located adjacent to and paralleling major roadways.

Allocations for drainage improvements to continue construction in the problem areas are a regular inclusion in Corpus Christi city bond elections. Protection of property has required that surface drainage be confined to relatively small channels in areas where the natural drainage patterns have often been indefinite. Naturally low and ponded areas have been drained. The per capita cost for these improvements have been relatively high and future improvements are projected to be increasingly more expensive.

Although no up-to-date map currently exists illustrating all of the underground and surface drainage systems in Corpus Christi, both the location as well as the description of existing facilities are on file separately, according to city officials.

A detailed comprehensive Master Drainage Plan of the City of Corpus Christi was completed in 1970 to update the 1961 Master Drainage Plan of the city. Drainage recommendations indicated by this study is regularly reviewed by city officials in developing 3- to 5-year capital improvement plans.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak elevation- and discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied within the community. Distinctly different types of hydrologic analyses were performed for stream (rainfall-runoff) sources versus tidal surge related sources.

Flood discharges of streams selected for a detailed analysis were based on the U. S. Geological Survey (USGS) open-file report 77-110 "Technique for Estimating the Magnitude and Frequency of Floods in Texas" (Reference 6). This technique was developed by the USGS through a regression analysis of existing gaged streamflow records. These results were then further refined for six specific regions within the state. The area of concern for this study is located within Region 1. Peak discharges for 10-, 50-, and 100-year frequencies were estimated from these relationships using the drainage area and channel slope for the streams in question. Peak discharges for the 500-year frequency events were determined by a straight line extrapolation of the 10-, 50-, and 100-year data on log-probability graph paper. The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
AIRPORT DRAINAGE DITCH					
Joe Mireur Road	2.60	450	700	760	1,000
DRAINAGE CREEK					
Limit of Detailed Study	19.85	1,810	2,950	3,420	4,800
Old Brownsville Road	17.88	1,680	2,730	3,150	4,400
Confluence of Airport Drainage Ditch	8.62	1,000	1,550	1,775	2,400
Joe Mireur Road	5.99	700	1,180	1,330	1,800
State Highway 44	4.89	670	1,010	1,140	1,500
TURNING BASIN TRIBUTARY					
Harbor Street	2.27	570	960	1,110	1,600
East Port Avenue	2.20	560	930	1,090	1,550
West Broadway	2.12	540	910	1,060	1,500
Nueces Street	1.82	490	810	940	1,350

TABLE 1 - SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
OSO BAY TRIBUTARY NO. 2					
Limit of Detailed Study	3.18	560	1,020	1,220	1,740
Rodd Field Road	2.62	500	925	1,120	1,590
Wooldridge Road	1.18	330	660	1,020	1,200
OSO BAY TRIBUTARY NO. 3					
S. Padre Island Drive	2.20	395	582	651	850
Lexington Road	1.95	363	530	592	770
Rodd Field Road	1.60	315	456	507	650
OSO CREEK					
FM 2444	144.0	12,500	19,400	23,700	56,100
Highway 43	131.3	11,900	19,200	23,200	54,900
Limit of Detailed Study	94.4	10,000	15,100	18,200	40,100
OSO CREEK TRIBUTARY NO. 6					
Limit of Detailed Study	4.98	613	895	1,000	1,300
Acushivet Road	4.32	553	803	894	1,150
Congressional Drive	3.00	427	606	671	900
Killarmet Drive	2.34	357	500	551	730
U. S. Government Railroad	1.10	208	280	304	390
OSO CREEK TRIBUTARY NO. 10					
Limit of Detailed Study	28.72	2,349	3,909	4,563	6,500
Saratoga Boulevard	27.10	2,254	3,738	4,359	6,150
Confluence with Drainage Creek	26.45	2,220	3,669	4,276	6,040
U. S. Government Railroad	5.45	618	890	989	1,270
S. Padre Island Drive	4.58	546	779	862	1,110
West Point Road	3.03	406	566	623	810
OSO CREEK TRIBUTARY NO. 14					
McGolin Road	5.76	810	1,280	1,470	2,000
State Highway 44	3.37	560	850	960	1,280
Limit of Detailed Study	2.01	380	570	640	850

TABLE 1 - SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
NAVIGATION BOULEVARD DRAINAGE DITCH					
Limit of Detailed Study	1.20	180	230	240	290
Old Brownsville Road	.94	150	190	200	240
STATE HIGHWAY 44 EAST DRAINAGE DITCH					
Confluence with Drainage Creek	3.24	500	730	820	1,060
Hopkins Road	1.59	340	510	580	780
STATE HIGHWAY 44 WEST DRAINAGE DITCH					
Confluence with Drainage Creek	3.24	500	730	820	1,060
Airport Access Road	2.59	420	620	690	900
Bronco Road	1.43	280	390	430	530
NUECES RIVER					
At Calallen Dam	16,920	51,900	95,600	115,200	161,700
At Mathis Dam	16,000	51,000	94,600	114,000	160,000

The procedures utilized to determine tidal surge-elevation relationships for the shoreline are based on joint probability methods that utilize historical data of individual storm parameters. The overall methodology was developed for use in Flood Insurance Studies by Tetra Tech, Inc. (Reference 7). The statistical distributions of the storm parameters which govern flood levels were examined both individually and collectively. From these distributions, a large population of "synthetic storms" were generated. Such storms are "synthetic" because they only resemble historically observed storms. The procedure permits the simulation of hundreds or even several thousand years of storms from which reliable estimates of flood recurrence intervals can be made. The major storm parameters necessary to define a storm are central pressure, radius to maximum winds, forward speed, direction of travel, point at which it crosses the coast, or the distance offshore if parallel to the coast. Each of these parameters is subjected to statistical analysis to determine its probability of occurrence.

The Tetra Tech methodology is based on the assumption that the parameters characterizing a tropical storm are independent of each other, therefore, the probability distribution for each parameter can be determined independently of the other parameters. Consequently, the probability of a tropical storm defined by a given combination of parameters has a probability equivalent to the

product of the probabilities of these parameters. The values representing the parameters used in this study and their assigned probabilities are shown in Table 2, "Parameter Values for Surge Elevation Computations." Following simulation of the storms, recurrence intervals (10-, 50-, 100-, and 500-year) for peak storm surge elevations at the shoreline were computed as specified in the Tetra Tech methodology.

In the present analysis, the astronomical tide amplitudes were added to the surge heights once the latter were processed and interpreted as surge height exceedence frequencies. For a given location, the two non-linear functions representing the exceedence curve for the surge heights and the probability density function for the astronomical tide were combined by means of a convolution integral to obtain a new exceedence curve containing the possible combinations of phase of the peak surges with the astronomical tide amplitudes. The probability density function for the astronomical tide is calculated as a Gaussian distribution based on tidal amplitudes generated at regular intervals for a period of time with the use of predictive equations that contain the harmonic constants for all the harmonic components of the tide at a particular location.

After an analysis of riverine flooding and an analysis of tidal flooding was completed along the streams so affected, the events were combined using combined probabilities. For specific elevations, the currence intervals of separate events were added together to find the recurrence interval for the combined event. The following equation was used:

$$T_R \text{ combined} = 1/[1/T_R \text{ riverine} + 1/T_R \text{ surge}]$$

where T_R riverine is the recurrence interval of the riverine event at a specific elevation, T_R surge is the recurrence interval of the tidal event at the same elevation, and T_R combined is the recurrence interval of the combined riverine and tidal event at the same elevation.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the studied streams as well as lowland area near the shoreline.

Cross sections for the backwater analyses of streams were obtained by field surveying using 3rd-order accuracy. Dimensions of all bridges and culverts were determined by field measurement or field checked to verify structural geometry from construction plans.

CENTRAL PRESSURE DEPRESSION (In.Hg)	29.72	29.20	28.32	27.55
PROBABILITY:	0.10	0.40	0.40	0.10
STORM RADIUS (Nautical Miles)	12.20	18.80	28.80	
PROBABILITY	0.30	0.48	0.28	
FORWARD SPEED (Knots)	6.70	11.50	14.70	12.20
PROBABILITY:	0.52	0.22	0.14	0.12
CROSSING ANGLE (Degrees)*	-34.0	221.00	264.00	302.00
PROBABILITY	0.11	0.19	0.48	0.22
FREQUENCY OF OCCURRENCE	0.00144 Storms/NM-YR			

*Positive clockwise from North.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

PARAMETER VALUES FOR SURGE ELEVATION COMPUTATIONS

The locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For streams for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (FBFM) (Exhibit 2).

The channel roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field inspection of each stream and its overbank area. For all streams except the revised portion of Oso Bay Tributary No. 2, a roughness coefficient of 0.045 was used for the main channel of the streams, and a roughness coefficient of 0.060 was used for the overbanks.

Water-surface elevations of floods, due to the streamflow, of the selected recurrence intervals were computed using the COE HEC-2 backwater computer program (Reference 8). The starting water-surface elevations for all streams studied were calculated using the slope/area method. Water-surface profiles were drawn showing computed water-surface elevations determined to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Because surge elevations of inland areas are often higher than those at the shoreline due to funneling and the movement of the surge onto higher ground, an overland propagation model (SURGEOD) was utilized to determine inland surge heights and flooding limits (Reference 7). SURGEOD is a one-dimensional model with movable boundary conditions which proceeds landward in its computations comparing the water-surface level at the landward limit with the ground level at the next landward elevation. When the water-surface level is higher than the ground level, a "wall" boundary condition is advanced one element landward until the surge level declines to zero. The propagation model generated on explicit finite difference solution to the hydrodynamic equation of long wave propagation. The momentum and continuity equations are utilized in non-linear transport form.

Input to the overland propagation model consists of surge levels (with the associated recurrence intervals derived from the storm surge model), Manning's friction coefficient, and ground elevations along the traverse. The principal output of the program includes flood levels for the 10-, 50-, 100-, and 500-year floods at each ground point on the traverse.

A grid consisting of 2.5 nautical miles per side was used throughout the study area. The grid extended from the Kleberg County/Kennedy County boundary to just north of East Matagorda Bay and offshore

approximately 63 miles. The grid covered an area of approximately 10,350 square miles.

Water depths for the offshore areas were obtained from National Ocean Survey Bathymetric maps at a scale of 1:250,000 and for near shore areas from National Ocean Survey hydrographic surveys with various dates and scales (References 9 and 10).

The final consideration in assessing the severity of flood hazards in the Bayside area as related to storm surge involves the determination of wave action during such storms.

The hydraulic analysis for Oso Bay Tributary No. 2 has been updated in this restudy to incorporate the effects of a channelization project and the addition of a bridge. Use of the combined probability methodology was incorporated into this revision. For the channelized portion of Oso Bay Tributary No. 2, Manning's roughness coefficient "n" values of 0.03 for the channel, and 0.045 for the overbanks were used.

3.3 Wave Height Analysis

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences report (Reference 11). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest elevation is 70 percent of the total wave height plus the stillwater elevation. The second major concept is that wave height may be diminished due to the presence of obstructions such as sand dunes, dikes, and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in Reference 11. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 3, "Transect Location Map," in accordance with the Users Manual for Wave Height Analysis (Reference 12). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

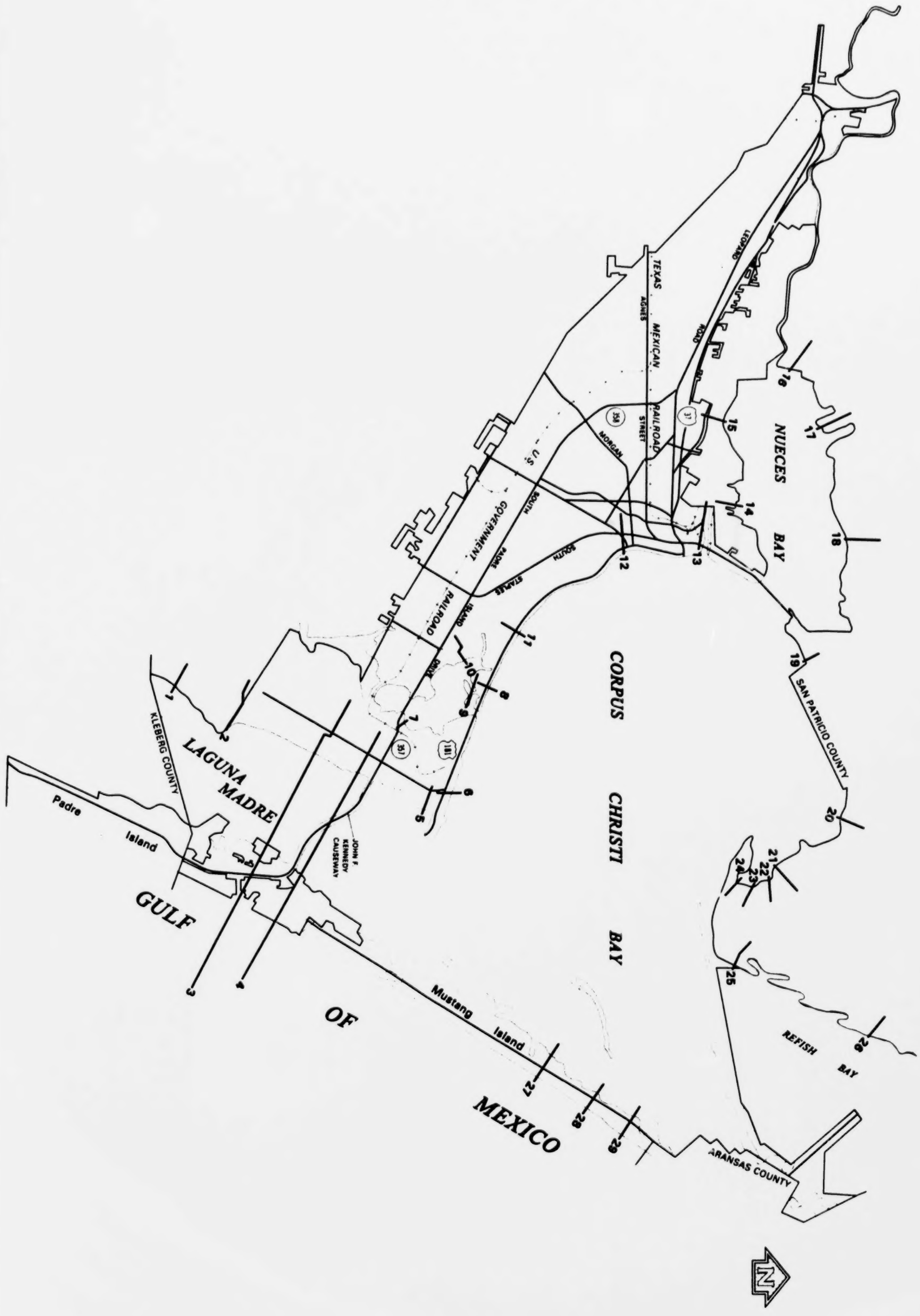


FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COUNTIES)

TRANSECT LOCATION MAP

The transects were continued inland until the wave was dissipated or until flooding from another source with equal to greater elevation was reached. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. Areas with a wave component 3-feet or greater were designated as velocity zones. Other areas subject to wave action were designated as A zones with base flood elevations adjusted to include wave crest elevations.

Figure 4 is a profile for a hypothetical transect showing the effects of energy dissipation on a wave as it moves inland. This figure shows the wave elevations being diminished by obstructions, such as buildings, vegetation, and rising ground elevations and being increased by open, unobstructed wind fetches. Actual wave conditions in the City of Corpus Christi may not necessarily include all the situations illustrated in Figure 4.

Computed wave elevations are based upon existing topography, vegetation and current development patterns and will require recomputation if significant changes occur in any of the above factors.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Mean Sea Level Datum of 1929.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 5 feet (Reference 13).

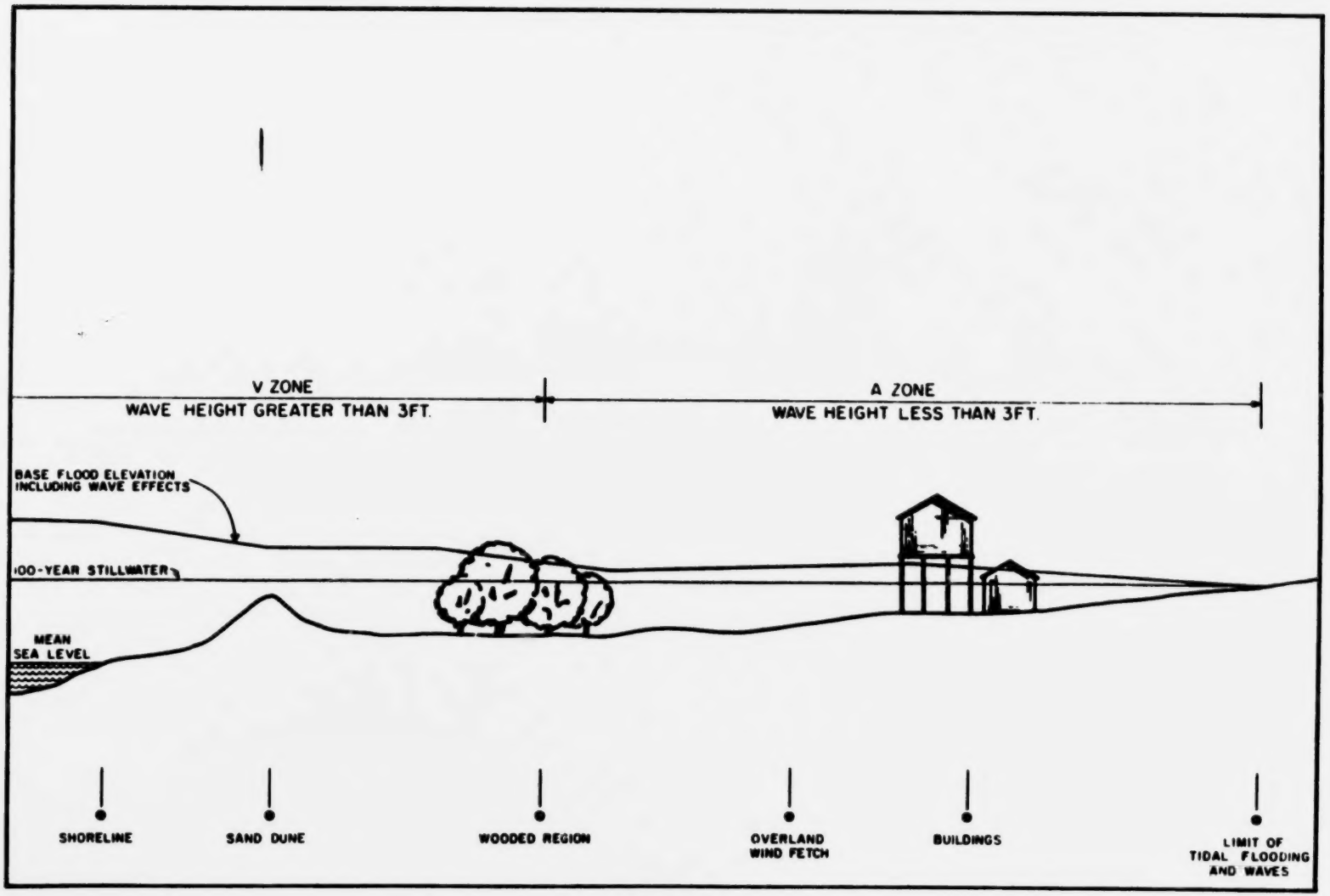


Figure 4
TYPICAL TRANSECT SCHEMATIC

The 100- and 500-year floodplains on the Oso Bay Tributary No. 2 have been revised from Rodd Field Road to Wooldridge Road to reflect updated topographic information. This information consists of a number of surveyed cross sections and notes from a survey conducted April 13, 1987 and later certified by the city surveyor for the City of Corpus Christi, Texas, Horacio Oliveira, on May 2, 1988.

The 100- and 500-year flood boundaries along the coastline were delineated along transects that were surveyed perpendicular to the shoreline. The flood boundary extensions between transects were located by interpolation and the assistance of the existing topographic maps (Reference 13).

The boundaries of the 100- and 500-year floods are boundaries shown on the Flood Insurance Rate Map (FIRM). On this map, the 100-year boundary corresponds to the areas of special flood hazards (Zones A and V) and the 500-year boundary corresponds to the boundary of moderate flood hazard (Zone B).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies. Floodways were not computed along reaches of streams dominated by coastal flooding.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 3).

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Airport Drainage Ditch								
A	425	91	463	1.6	33.9	33.9	34.9	1.0
B	895	90	384	2.0	34.2	34.2	35.1	0.9
C	1,375	96	361	2.1	34.7	34.7	35.4	0.7
Drainage Creek								
A	2,100	89	789	4.3	24.4	24.4	25.4	1.0
B	5,000	197	1,045	3.1	26.7	26.7	27.7	1.0
C	6,300	102	1,024	3.2	27.4	27.4	28.4	1.0
D	9,200	175	1,748	1.8	29.2	29.2	30.0	0.8
E	12,733	170	1,454	1.8	30.4	30.4	31.2	0.8
F	14,533	190	1,414	1.7	30.8	30.8	31.5	0.7
G	16,533	160	989	2.4	31.5	31.5	32.1	0.6
H	17,957	124	1,116	2.0	32.4	32.4	33.4	1.0
I	19,757	66	550	3.2	33.4	33.4	34.3	0.9
J	21,483	100	684	1.9	34.8	34.8	35.8	1.0
K	22,783	30	331	3.4	35.5	35.5	36.4	0.9
L	24,533	76	624	2.1	36.6	36.6	37.3	0.7
M	26,033	62	412	3.0	37.2	37.2	37.9	0.7
N	27,933	86	456	2.5	38.8	38.3	39.8	1.0

[1]Feet above mouth for Airport Drainage Ditch; feet above 100 feet above mouth for Drainage Creek.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOODWAY DATA

AIRPORT DRAINAGE DITCH-DRAINAGE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Turning Basin Tributary								
A	10	32	306	6.3	11.8	5.7[2]	6.7	1.0
B	478	40	374	5.1	11.8	8.0[2]	8.4	0.4
C	1,094	58	535	3.6	11.8	9.2[2]	9.7	0.5
D	1,394	66	430	4.4	11.8	9.3[2]	9.7	0.4
E	2,200	56	481	3.9	11.8	9.4[2]	10.1	0.7
F	2,421	62	556	3.3	11.8	9.5[2]	10.4	0.9
G	3,735	58	519	3.2	11.8	9.6[2]	10.6	1.0
Oso Bay Tributary No. 2								
A[3]	0	108[4]	377	3.2	9.6	5.3[2]	6.3	1.0
B	1,500	284[4]	836	1.4	9.6	7.1[2]	7.3	0.2
C	3,190	88	421	2.7	9.6	7.9[2]	8.1	0.2
D	5,183	123	497	2.3	11.4	11.3[2]	12.3	1.0
E	7,483	44	215	4.7	14.9	14.9	15.6	0.7

[1]Feet above Harbor Street for Turning Basin Tributary; feet above 5,170 feet below Rodd Field Road for Oso Bay Tributary No. 2

[2]Elevation computed without consideration of coastal flooding effects

[3]Cross section not shown on map, located outside corporate limits

[4]Floodway lies outside corporate limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOODWAY DATA

TURNING BASIN TRIBUTARY - OSO BAY TRIBUTARY NO. 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Bay Tributary No. 3								
A	50	64	341	3.6	9.4	5.3[2]	6.3[2]	1.0
B	261	64	299	4.1	9.4	5.6[2]	6.6[2]	1.0
C	3,535	62	283	4.1	11.5	11.5	12.5	1.0
D	6,185	63	396	2.5	15.3	15.3	15.6	0.3
Oso Creek Tributary No. 6								
A[3]	3,923	60	401	3.9	18.3	18.3	18.6	0.3
B[3]	4,826	58	435	3.4	18.9	18.9	19.1	0.2
C	6,086	36	381	3.8	19.8	19.8	20.8	1.0
D	7,186	33	311	3.4	21.0	21.0	22.0	1.0
E	8,163	33	262	4.0	22.2	22.2	23.2	1.0
F	8,778	92	443	2.4	22.6	22.6	23.6	1.0
G	9,350	33	281	2.8	23.1	23.1	24.1	1.0
H	10,610	81	418	1.9	23.5	23.5	24.5	1.0
I	11,910	47	388	2.0	23.8	23.8	24.8	1.0
J	12,650	33	267	2.9	24.0	24.0	25.0	1.0
Oso Creek Tributary No. 10								
A[3]	2,300	167	993	4.9	20.8	17.4[4]	18.3[4]	0.9
B	4,000	191	1,511	3.2	20.8	19.3[4]	20.3[4]	1.0
C	6,550	160	1,092	4.3	21.1	21.1	22.1	1.0
D	8,233	258	1,518	3.0	22.8	22.8	23.6	0.8

[1]Feet above 850 feet above mouth for Oso Bay Tributary No. 3; feet above 700 feet above mouth for Oso Creek Tributary No. 6; feet above mouth for Oso Creek Tributary No. 10. [2]Elevation computed without consideration of coastal flooding effects. [3]Cross section not shown on map, located outside corporate limits. [4]Elevation computed without consideration of backwater effects.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOODWAY DATA

OSO BAY TRIBUTARY NO. 3-OSO CREEK TRIBUTARY NO. 6-OSO CREEK TRIBUTARY NO. 10

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek Tributary No. 10(cont.)								
E	9,633	66	517	3.4	23.8	23.8	24.6	0.8
F	10,833	59	361	4.9	25.4	25.4	25.8	0.4
G	12,091	49	452	3.8	30.4	30.4	31.4	1.0
H	13,396	59	407	4.1	30.6	30.6	31.5	0.9
I	14,796	54	341	4.8	30.7	30.7	31.6	0.9
J	15,968	48	324	5.1	31.0	31.0	32.0	1.0
K	16,122	45	327	4.9	31.1	31.1	32.1	1.0
L	17,376	55	351	4.2	31.5	31.5	32.4	0.9
M	18,468	38	358	3.6	32.0	32.0	33.0	1.0
N	20,118	51	354	3.3	32.3	32.3	33.2	0.9
O	21,676	55	335	3.3	32.5	32.5	33.3	0.8
Oso Creek Tributary No. 14[2]								
A[2]	0	53	346	5.2	30.6	30.6	31.6	1.0
B[3]	3,060	50	323	5.2	36.0	36.0	36.0	0.0
C[2]	4,110	56	332	4.9	37.6	37.6	37.6	0.0
D[2]	6,548	54	307	5.1	41.1	41.1	41.1	0.0
E	8,768	43[3]	388	3.8	43.7	43.7	43.7	0.0
F	11,255	307[3]	840	1.6	44.8	44.8	45.4	0.6
G	12,655	327[4]	1,005	1.1	45.0	45.0	45.9	0.9
H	13,135	399	1,300	0.8	45.0	45.0	45.9	0.9
I	14,435	422	1,455	0.7	45.1	45.1	46.1	1.0
J	16,435	445	1,314	0.7	45.2	45.2	46.2	1.0
K	17,385	357	972	1.0	45.3	45.3	46.3	1.0

[1]Feet above mouth for Oso Creek Tributary No. 10; feet above 1800 feet above mouth for Oso Creek Tributary No. 14. [2]Cross section not shown on map, [3]located outside corporate limits. [4]Floodway width extends beyond corporate limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOODWAY DATA

OSO CREEK TRIBUTARY NO. 10-OSO CREEK TRIBUTARY NO. 14

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oso Creek Tributary No. 14(cont.)								
L	17,509	50	315	3.0	45.9	45.9	46.3	0.4
M	18,263	250	900	0.8	46.3	46.3	46.6	0.3
N	19,463	250	861	0.8	46.3	46.3	46.9	0.6
O	20,463	250	664	1.0	46.3	46.3	47.1	0.8
P	21,513	278	850	0.8	46.4	46.4	47.4	1.0
Navigation Boulevard Drainage Ditch								
A	0	60	243	1.0	36.6	36.6	37.6	1.0
B	1,787	34	114	1.7	37.2	37.2	38.2	1.0
State Highway 44 East Drainage Ditch								
A	700	17	69	6.0	39.9	39.9	40.9	1.0
B	2,426	35	131	3.1	41.7	41.7	42.7	1.0
State Highway 44 West Drainage Ditch								
A	1,300	138	402	1.9	39.8	39.8	40.8	1.0
B	2,440	125	228	3.0	40.7	40.7	41.7	1.0
C	3,791	100	343	1.7	42.8	42.8	43.1	0.3
D	6,591	114	284	1.5	44.0	44.0	44.7	0.7
E	7,950	120	357	0.8	44.3	44.3	45.3	1.0

[1]Feet above 1800 feet above mouth for Oso Creek Tributary No. 14; feet above mouth for Navigation Boulevard Drainage Ditch, State Highway 44 East Drainage Ditch and State Highway 44 West Drainage Ditch.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOODWAY DATA

OSO CREEK TRIBUTARY NO. 14- NAVIGATION BOULEVARD DRAINAGE DITCH-STATE HIGHWAY 44 EAST DRAINAGE DITCH-STATE HIGHWAY 44 WEST DRAINAGE DITCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Nueces River								
A	0	8,166[2]	52,713	2.2	14.0	10.9[3]	11.8	0.9
B	215	7,364[2]	21,519	5.4	14.0	11.0[3]	12.0	1.0
C	3,415	2,815[2]	22,295	5.2	14.0	13.3[3]	14.3	1.0
D	3,577	2,762[2]	21,194	5.4	14.0	13.7[3]	14.6	0.9
E	9,177	7,544[2]	78,651	1.5	14.8	14.8	15.7	0.9
F	13,077	13,087[2]	137,039	0.8	14.9	14.9	15.8	0.9
G	15,077	13,859[2]	139,601	0.8	14.9	14.9	15.8	0.9
H	17,677	15,469[2]	153,422	0.8	15.0	15.0	15.9	0.9
I	20,777	14,167[2]	106,040	1.1	15.0	15.0	15.9	0.9
J	22,877	15,153[2]	126,505	0.9	15.1	15.1	16.0	0.9
K	25,477	12,402[2]	80,235	1.4	15.3	15.3	16.3	1.0
L	26,977	14,170[2]	94,671	1.2	15.4	15.4	16.4	1.0
M	29,077	14,908[2]	85,213	1.4	15.7	15.7	16.7	1.0
N	31,577	16,378[2]	76,791	1.5	16.1	16.1	17.1	1.0

[1]Feet above 200 feet downstream of Missouri Pacific Railroad.
[2]Floodway width extends beyond corporate limits.
[3]Water-surface elevation computed without consideration of backwater effects from Nueces Bay.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

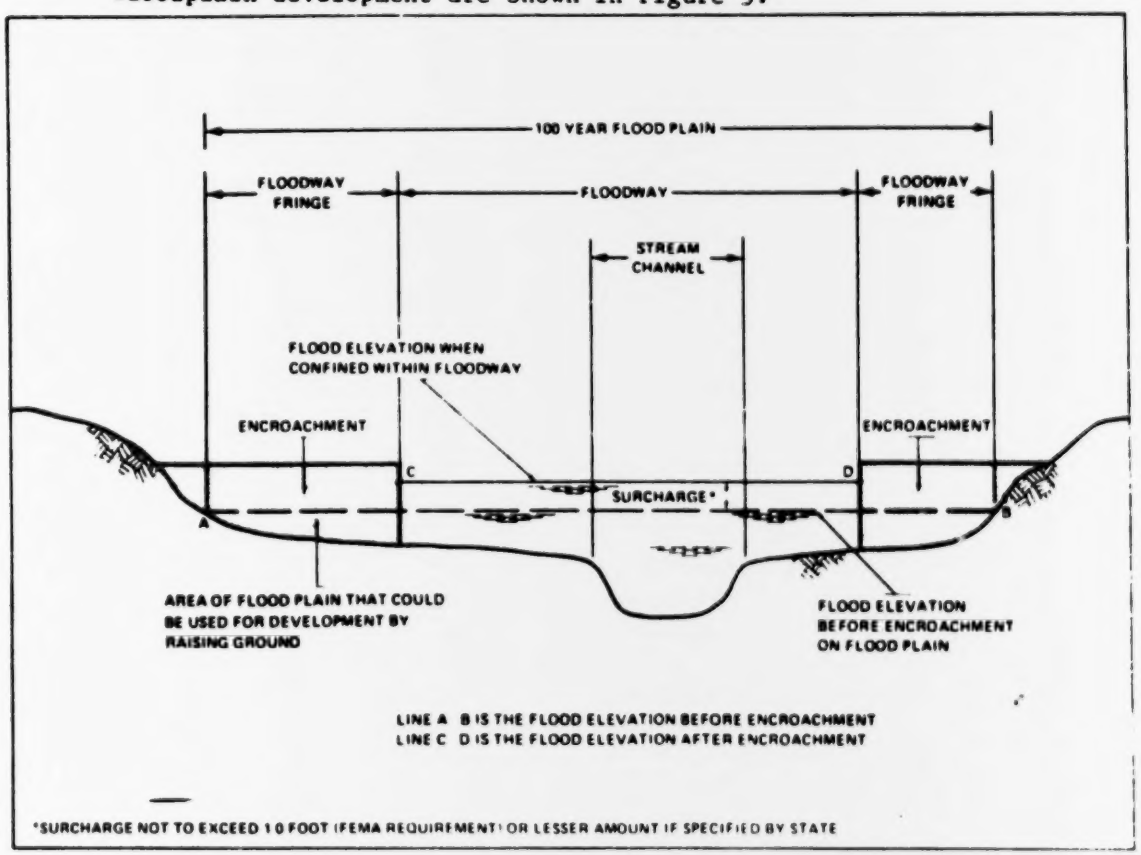
(NUECES AND KLEBERG COS.)

FLOODWAY DATA

NUECES RIVER

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway limits were located by determining floodway widths at various cross sections and utilizing interpolated widths in the areas between cross sections. In cases where the floodway and the 100-year boundaries are practically indistinguishable on the Flood Boundary and Floodway Map, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 5.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC - Figure 5

4.3 Base Flood Elevations

Areas within the community studied by detailed engineering methods have base flood elevations established in A and V Zones. These are the elevations of the base 100-year flood relative to the National

Geodetic Vertical Datum (mean sea level of 1929). In coastal areas affected by wave action, base flood elevations are generally maximum at the normal open shoreline. These elevations generally decrease in a landward direction at a rate dependent on the presence of obstructions capable of dissipating the wave energy. Where possible, changes in base flood elevations have been shown in 1-foot increments on the FIRMs. However, where the scale did not permit 2- or 3-foot increments were sometimes used. Base flood elevations shown in the wave action areas represent the average elevation within the zone. Current program regulations generally require that all new construction be elevated such that the first floor, including basement, is above the base flood elevation in A and V Zones.

4.4 Velocity Zones

The COE has established the 3-foot wave as the criterion for identifying coastal high hazard zones (Reference 14). This was based on a study of wave action effects on structures. This criterion has been adopted by FEMA for the determination of V zones. Because of the additional hazards associated with high-energy waves, the National Flood Insurance Program regulations require much more stringent floodplain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in V zones are higher than those in A zones with similar numerical designations.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the City of Corpus Christi.

5.1 Reach Determinations

Reaches are defined as sections of floodplain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Corpus Christi are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

Coastal floodplains are divided into areas having relatively the same flood hazard based upon the 100-year wave height, and the average weighted difference in water-surface elevations between the 10-year and 100-year floods. These flood hazard areas are shown on the Flood Insurance Rate Map.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one- half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

In coastal areas subject to wave action (wave heights greater than 3 feet), the FHF is determined using the difference between the 10-year and 100-year wave crest elevations. This difference is estimated as the difference between the 10- and 100-year stillwater elevations multiplied by 1.55. For areas where wave heights are less than three feet, the FHF is determined using the difference between the 10-year stillwater elevation and the 100-year wave crest elevation. For areas protected from wave action, the FHF is determined using the difference between the 10- and 100-year stillwater elevations.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Airport Drainage Ditch							
Reach 1	165	-2.4	-0.5	+1.0	025	A5	Varies
Drainage Creek							
Reach 1	165,277 280	-2.5	-0.5	+0.9	025	A5	Varies
Oso Bay Tributary No. 2							
Reach 1	315	-1.4	-0.4	+0.6	015	A3	Varies
Oso Bay Tributary No. 3							
Reach 1	304,315	-0.9	-0.3	+0.5	010	A2	Varies
Oso Creek							
Reach 1	277,280	-3.5	-1.0	+4.4	035	A7	21
Oso Creek Tributary No. 6							
Reach 1	283,284	-1.2	-0.4	+0.6	010	A2	Varies
Oso Creek Tributary No. 10							
Reach 1	165,168 277	-1.9	-0.5	+1.1	020	A4	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD INSURANCE ZONE DATA

AIRPORT DRAINAGE DITCH-DRAINAGE CREEK- OSO BAY TRIBUTARY NO. 2-OSO BAY TRIBUTARY NO. 3-OSO CREEK- OSO CREEK TRIBUTARY NO. 6-OSO CREEK TRIBUTARY NO. 10

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Oso Creek Tributary No. 14 Reach 1	145	-1.0	-0.3	+0.7	010	A2	Varies
Navigation Boulevard Drainage Ditch Reach 1	165	-0.7	-0.1	+0.4	005	A1	Varies
State Highway 44 East Drainage Ditch Reach 1	165	-1.0	-0.2	+0.7	010	A2	Varies
State Highway 44 West Drainage Ditch Reach 1	145,165	-0.7	-0.1	+0.3	005	A1	Varies
Nueces River Reach 1	18,19 106,107	-2.9	-0.9	+1.3	030	A6	Varies
Reach 2	18*	*	*	*	045	A9	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

*Taken from Nueces County FIS dated September 3, 1976.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD INSURANCE ZONE DATA

OSO CREEK TRIBUTARY NO. 14-NAVIGATION BOULEVARD DRAINAGE DITCH-STATE HIGHWAY 44 EAST DRAINAGE DITCH-STATE HIGHWAY 44 WEST DRAINAGE DITCH-NUECES RIVER

Zones A1, A2, A3 A4, A5, A6, A7, A9, A10, A11,A12,A13, A14,A15,A16, A18,A20,A21, & A24:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zones V11,V14,V15, V17,V18,V20, V21,V22,V23, & V24:	Special Flood Hazard Areas along coasts inundated by the 100-year flood, as determined by detailed methods, and that have additional hazards due to velocity (3 feet or more of wave action); base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Table 4, "Flood Insurance Zone Data," and Table 5, "Coastal Flood Insurance Zone Data," summarize the flood elevations, differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Corpus Christi is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

A Flood Insurance Study for the City of Corpus Christi was prepared by the Galveston District of the COE in June 1970 for the Federal Insurance Administration, and was revised in 1975 (Reference 1). Total stillwater

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Laguna Madre	1	355,356,360	0.9	7.97	9.82	12.41	140	V24	13-12
			0.9	7.97	9.82	12.41	100	A20	11-10
	2	355,356,360	0.9	7.97	9.82	12.41	140	V24	13-12
			0.9	7.97	9.82	12.41	100	A20	11-10
Gulf of Mexico/ Laguna Madre	3	318,319, 338,339, 356,360,380	2.36	5.95	7.03	9.14	070	V14	11-9
			2.36	5.95	7.03	9.14	065	A13[3]	9-8
			1.69	7.81	9.16	12.13	065	A13[3]	11-10
			1.63	7.79	9.53	12.06	120	V22	12-11
			1.63	7.79	9.53	12.06	090	A18	11-10
	4	316,317,318, 319,338,339, 340,345	2.36	5.95	7.03	9.14	070	V14	11-9
			2.36	5.95	7.03	9.14	065	A13[3]	9-8
			1.69	7.81	9.16	12.13	065	A13[3]	11-10
			1.83	7.50	8.66	11.56	120	V22[3]	11-9
			1.83	7.50	8.66	11.56	080	A16[3]	10-9
	See 4 footnote	355,360,375, 380	3.7	6.5	7.1	8.4	055	V11	11-10
			3.7	6.5	7.1	8.4	050	A10[3]	9-7
			3.7	6.5	7.1	8.4	075	V15[3]	11-10
			3.2	6.6	8.8	10.0	060	A12	10-9
Corpus Christi Bay/ Oso Bay	7	304,308,315, 316	3.19	7.77	8.85	11.69	090	V18	14-11
			3.63	8.13	9.24	11.64	065	A13	10-9

1-Includes the effects of Wave Action, where applicable.

2-Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted

3-Weighted Average value.

4- Information for the area of Corpus Christi located in Kleberg Co. was taken from the Kleberg County, Texas Flood Insurance Study

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

COASTAL FLOOD INSURANCE ZONE DATA

LAGUNA MADRE-GULF OF MEXICO/LAGUNA MADRE-CORPUS CHRISTI BAY/ OSO BAY

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Corpus Christi Bay/ Oso Bay	8	304,315	2.90 2.90	8.18 8.18	9.38 9.38	12.61 12.61	100 075	V20 A15	14-12 11-9
	9	304,308	3.19 3.63	7.77 8.13	8.85 9.24	11.69 11.64	090 075	V18[3] A15[3]	12-11 10-9
	10	302,303,304	2.90	8.18	9.38	12.61	075	A15	11-9
Oso Bay/Oso Bay Tributary No. 2	7	315	7.6	8.1	9.6	11.6	020	A4	11-10
Oso Bay/Oso Bay Tributary No. 3	8	315	7.4 9.5	8.4 10.5	9.4 11.5	10.4 12.5	020 020	A4 A4	11-9 12
Corpus Christi Bay	5	309,317,330, 340,338,339	2.92 2.82 2.82	7.02 6.98 6.98	8.11 8.55 8.55	10.55 10.85 10.85	090 090 075	A18[3] V18[3] A15[3]	10 11 10
	6	308,309,330, 340	2.82 2.82	6.98 6.98	8.55 8.55	10.85 10.85	090 070	V18 A14	13-11 10-9
	11	301,302,304	2.90 2.90	8.18 8.18	9.38 9.38	12.61 12.61	100 075	V20 A15	14-12 11-9

1-Includes the effects of Wave Action, where applicable.

2-Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted.

3-Weighted average value.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

COASTAL FLOOD INSURANCE ZONE DATA

CORPUS CHRISTI BAY/OSO BAY-OSO BAY/OSO BAY TRIBUTARY NO. 2-OSO BAY/OSO BAY TRIBUTARY NO. 3-CORPUS CHRISTI BAY

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Corpus Christi Bay	12	169	2.90 2.90	8.18 8.18	9.38 9.38	12.61 12.61	100 075	V20 A15	14-12 11-9
	13	159,167,169	2.59 2.59	8.73 8.73	10.19 10.19	13.64 13.64	120 080	V22[3] A16[3]	15-13 12-10
	19	100,200	2.75	8.61	10.06	13.31	110	V21	15-13
	20	100,185,205	3.15 3.15	9.22 9.22	10.58 10.58	13.40 13.40	120 080	V22 A16	13 12-11
	21,22,23,24	205	2.66 2.66	7.25 7.25	8.39 8.39	11.40 11.40	060 055	A12[3] A11	9 8
Corpus Christi Bay/ Nueces Bay	14	154,158,159,166,167	2.58	10.23	11.18	15.51	090	A18[3]	12
	15	134,153,154,155	2.78	11.78	13.38	17.55	110	A21[3]	13
	16	19,38,130,131,132,134,155	1.87	12.21	13.97	17.94	140	A24[3]	14
	17	75,155,160	2.48	11.18	12.85	16.60	110	V21[3]	16-15

1-Includes the effects of Wave Action, where applicable.

2-Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted.

3-Weighted Average Value.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

COASTAL FLOOD INSURANCE ZONE DATA

CORPUS CHRISTI BAY-CORPUS CHRISTI BAY/NUECES BAY

FLOODING SOURCE	TRANSECTS	PANELS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR[1]	ZONE[1]	BASE FLOOD ELEVATION[2] (FEET NGVD)
			10-YR	50-YR	100-YR	500-YR			
Corpus Christi Bay/ Nueces Bay	18	75,100,160, 200	2.65	9.49	11.17	14.53	130	V23	16-14
Gulf of Mexico/ Red Fish Bay	25	185,205,210, 215,220,240	2.57 2.57	6.89 6.89	7.98 7.98	10.76 10.76	085 065	V17 A13	11 10-8
	26	210,220,227, 229,230,240	2.45	6.61	7.61	9.65	090	V18[3]	11-10
Gulf of Mexico/ Corpus Christi Bay	27	220,240,330, 335,345	2.53 2.53 2.92	6.09 6.09 7.02	7.02 7.02 8.11	8.88 8.88 10.55	070 065 065	V14[3] A13[3] A13[3]	11-10 9-7 8
Gulf of Mexico/ Corpus Christi Bay	28	335,240	2.53 2.53	6.09 6.09	7.02 7.02	8.88 8.88	070 055	V14 A11	11-10 9-7
Gulf of Mexico/ Red Fish Bay	29	210,220,227, 229,230,237, 240	2.50 2.50 2.45	5.85 5.85 6.61	6.78 6.78 7.61	8.45 8.45 9.65	070 055 055	V14[3] A11[3] A11[3]	10-9 8-7 8

1-Includes the effects of Wave Action, where applicable.

2-Due to map scale limitations, Base Flood Elevations (BFEs) shown on the Flood Insurance Rate Map may represent average elevation for the zone depicted.

3-Weighted Average Value.

*These elevations are not available.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

COASTAL FLOOD INSURANCE ZONE DATA

CORPUS CHRISTI BAY/NUECES BAY-GULF OF MEXICO/REDFISH BAY-GULF OF MEXICO

elevations for the 100-year frequency were estimated to be generally 12-14 feet in elevation. Wave heights were not included nor were streamflow sources included.

Wave height analyses are concurrently being performed for the unincorporated areas of Nueces County. The results of the county study will be in agreement with this study.

Because it is based on more up-to-date analyses, this study supersedes the previously-printed Flood Insurance Study for the City of Corpus Christi (Reference 15).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201-3698.

8.0 BIBLIOGRAPHY AND REFERENCES

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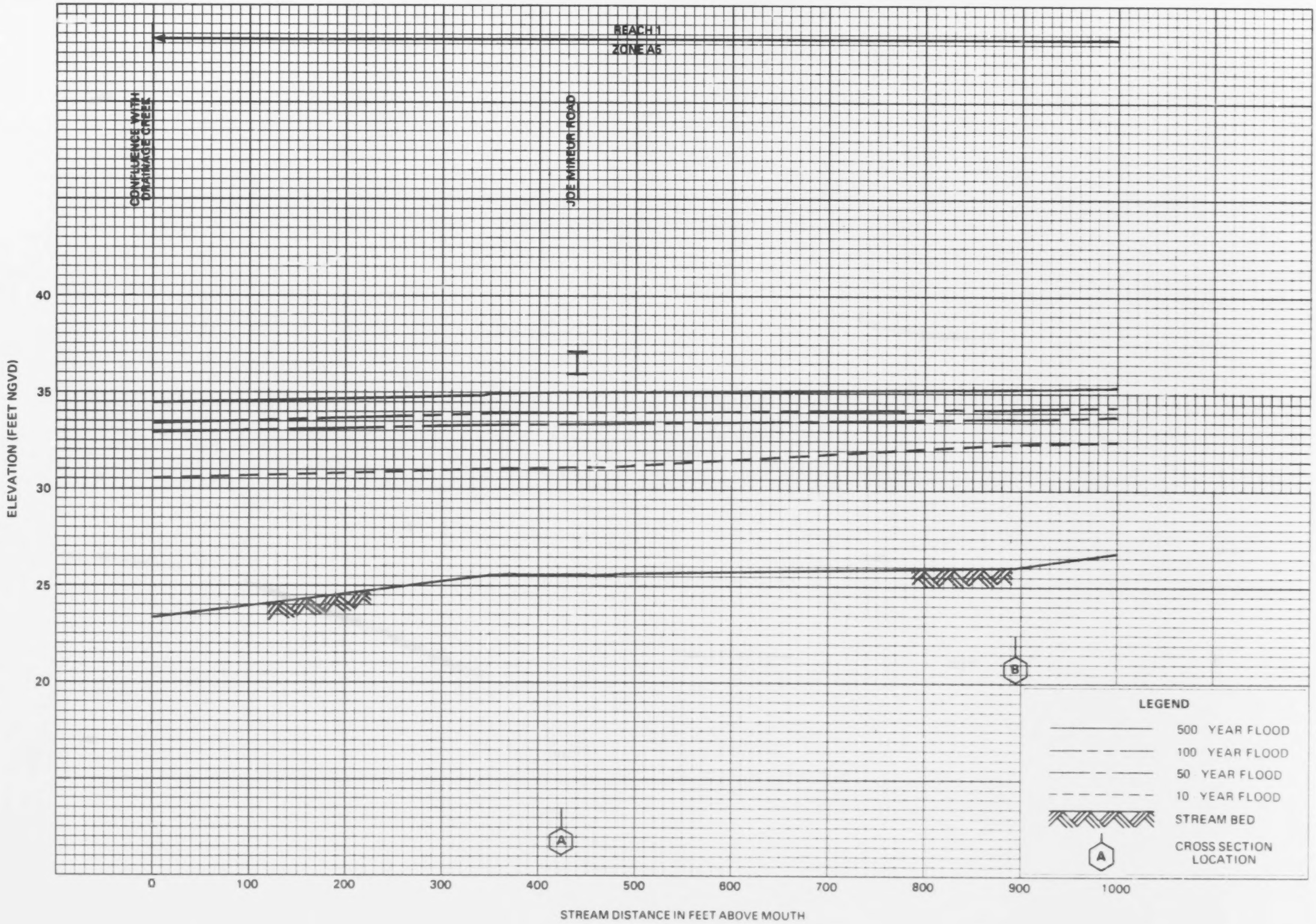


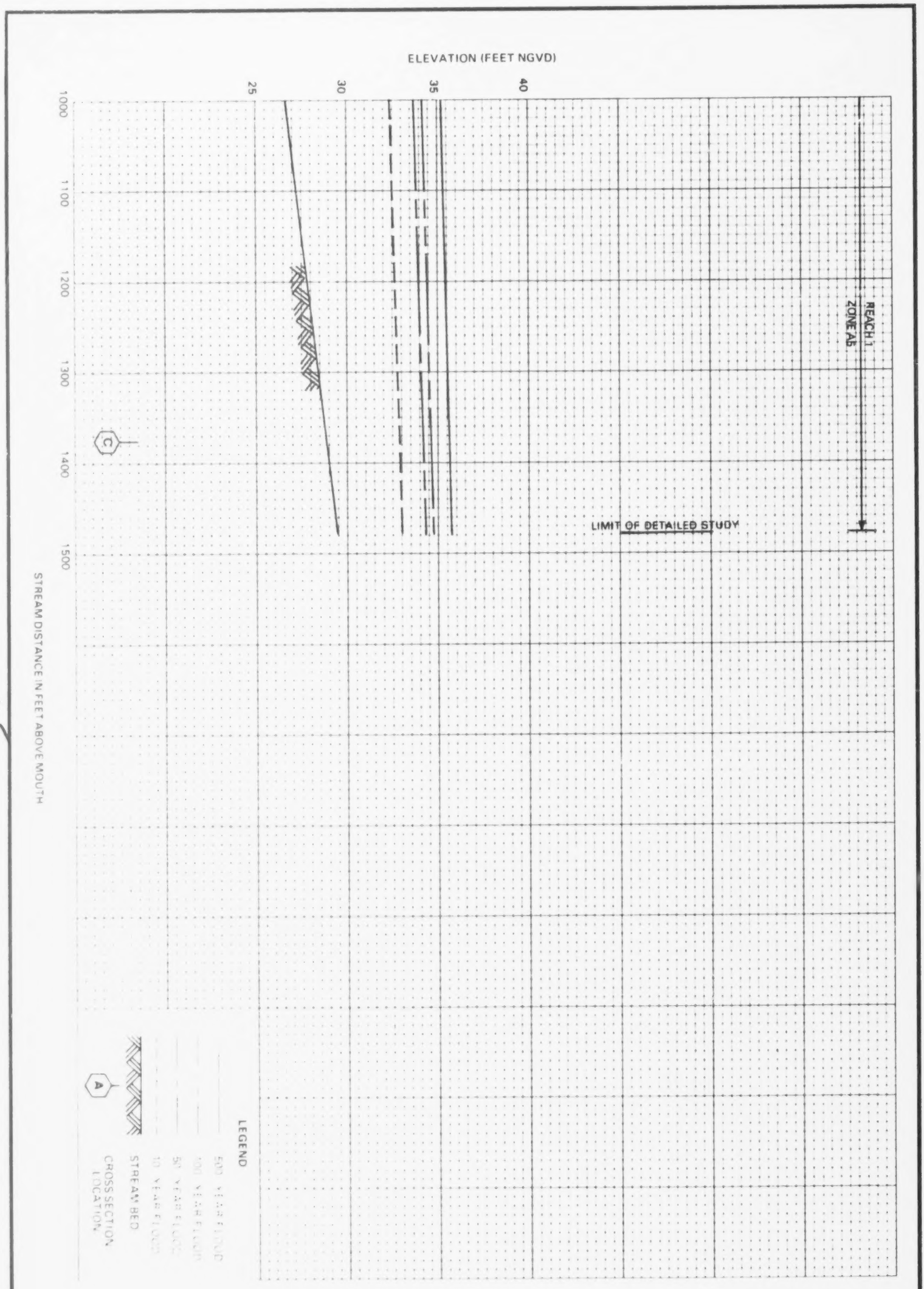
FLOOD PROFILES

AIRPORT DRAINAGE DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX
(NUECES AND KLEBERG COS.)

01P



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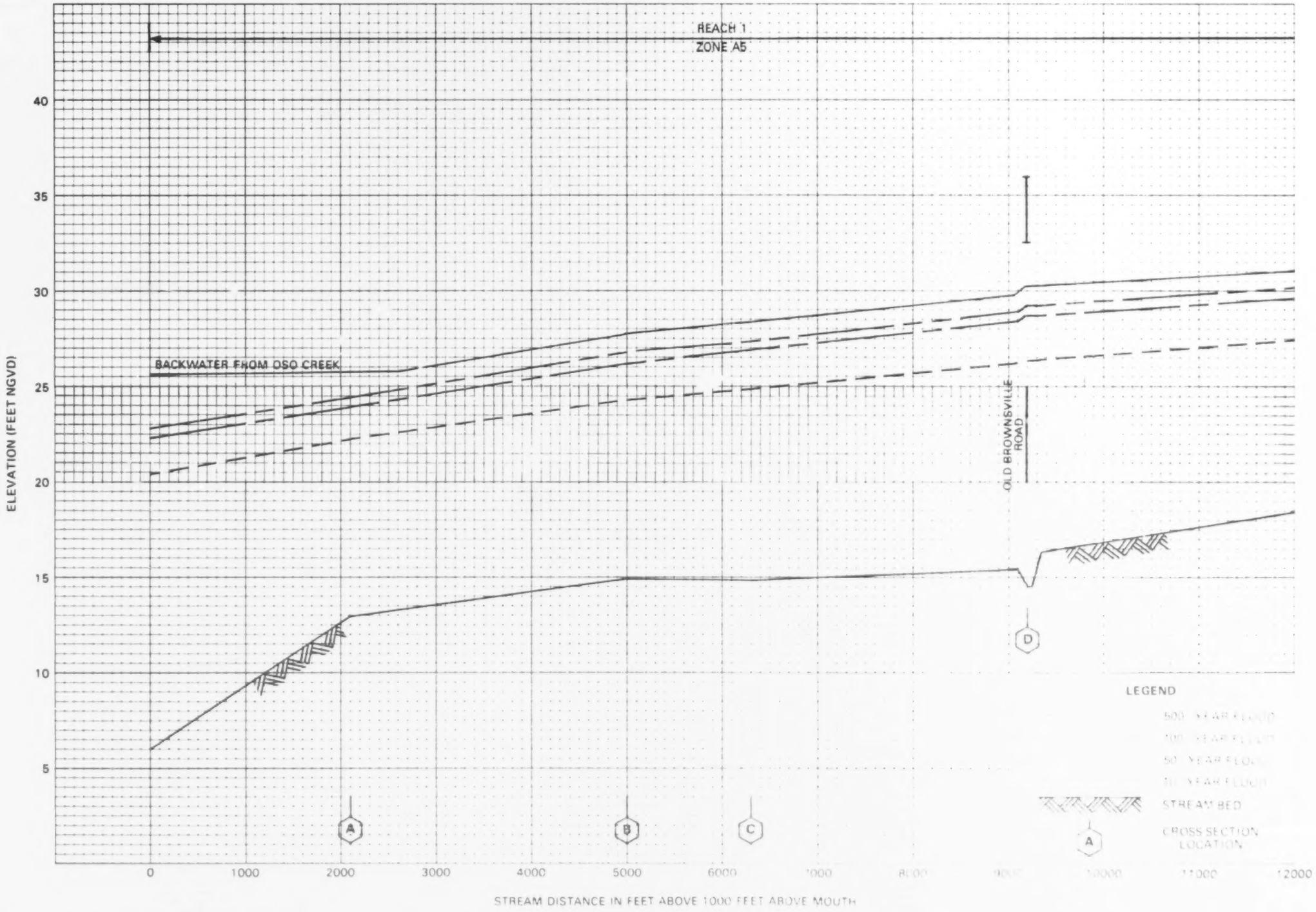


FLOOD PROFILES

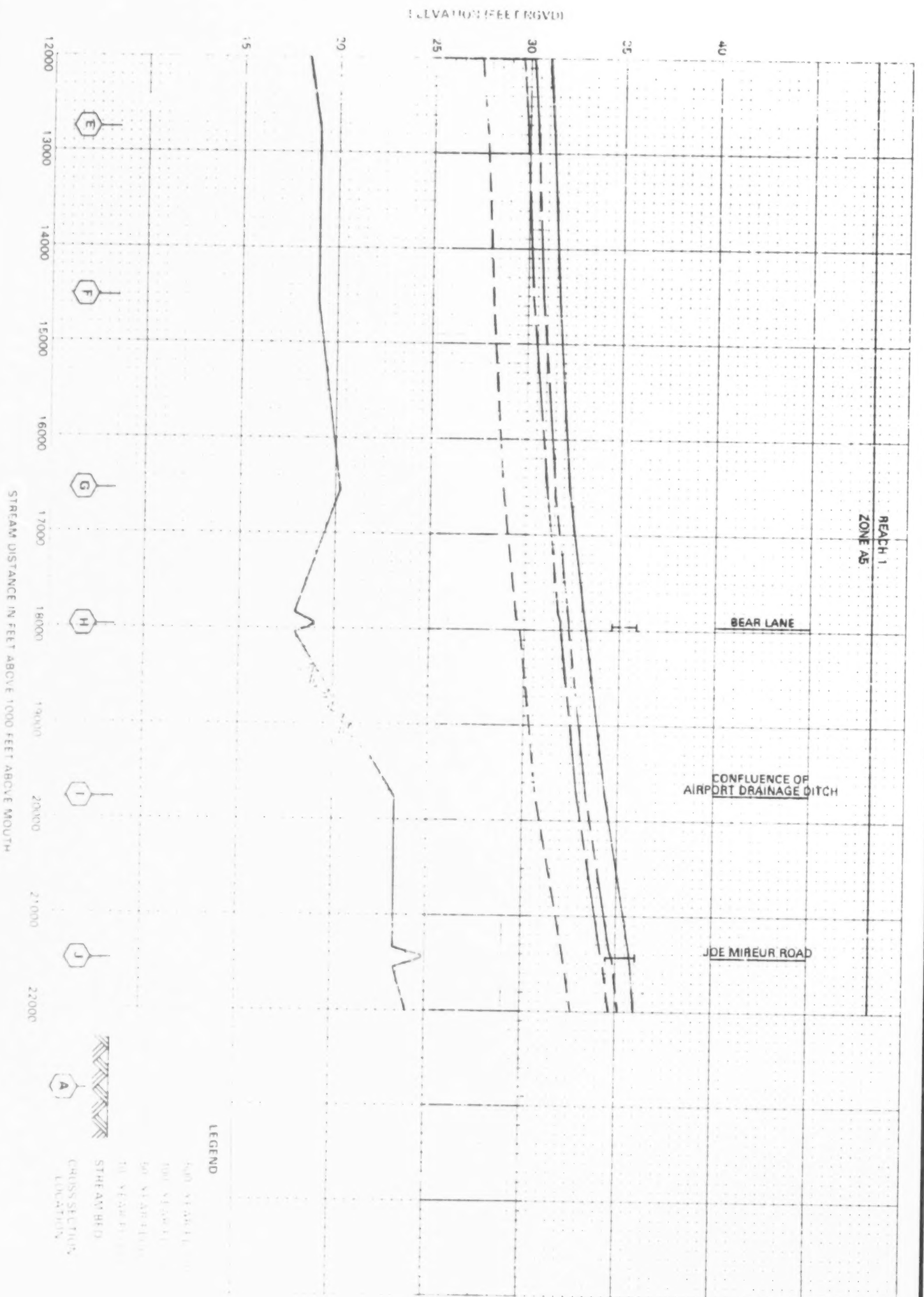
DRAINAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

03P



04P

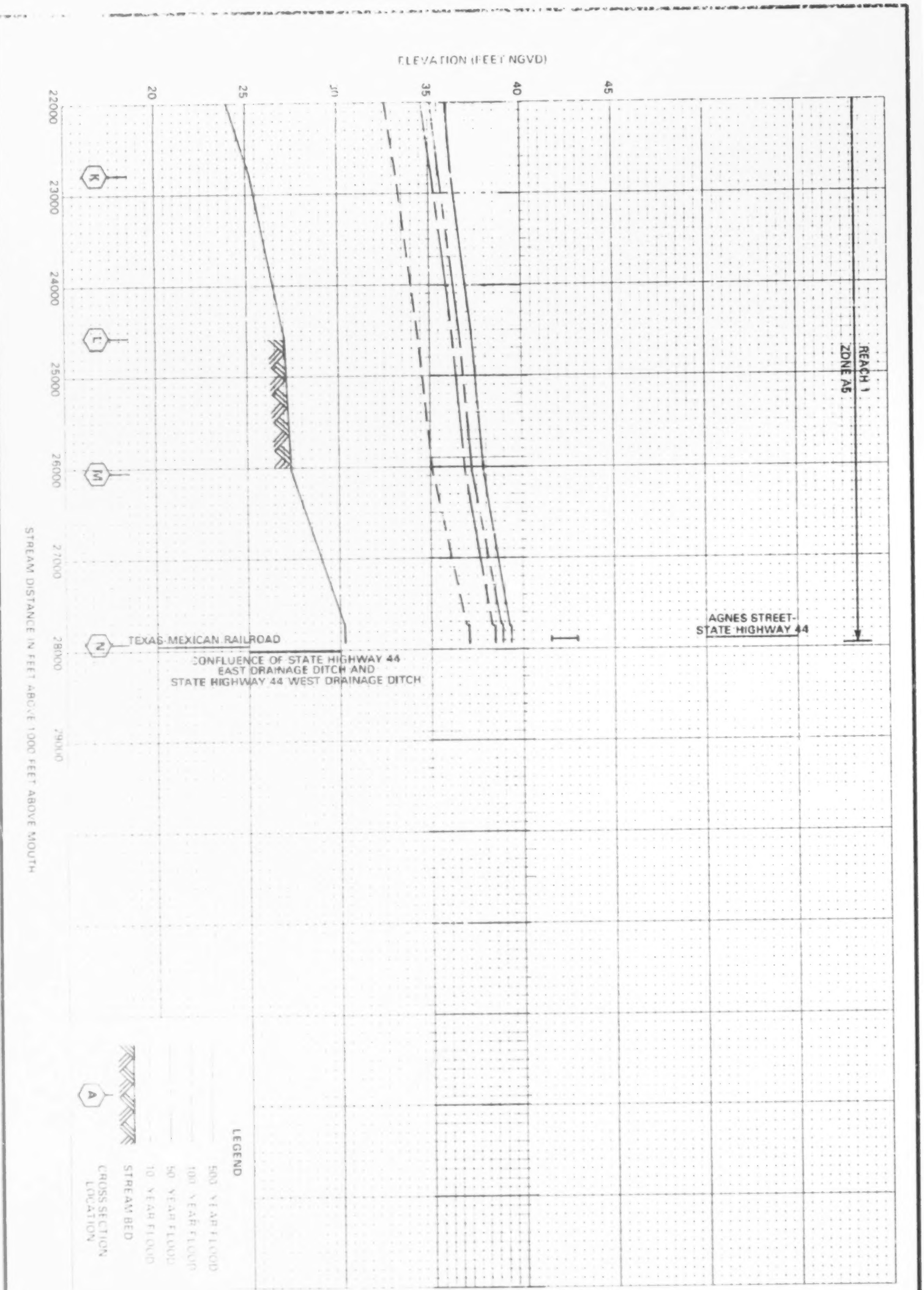
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD PROFILES

DRAINAGE CREEK



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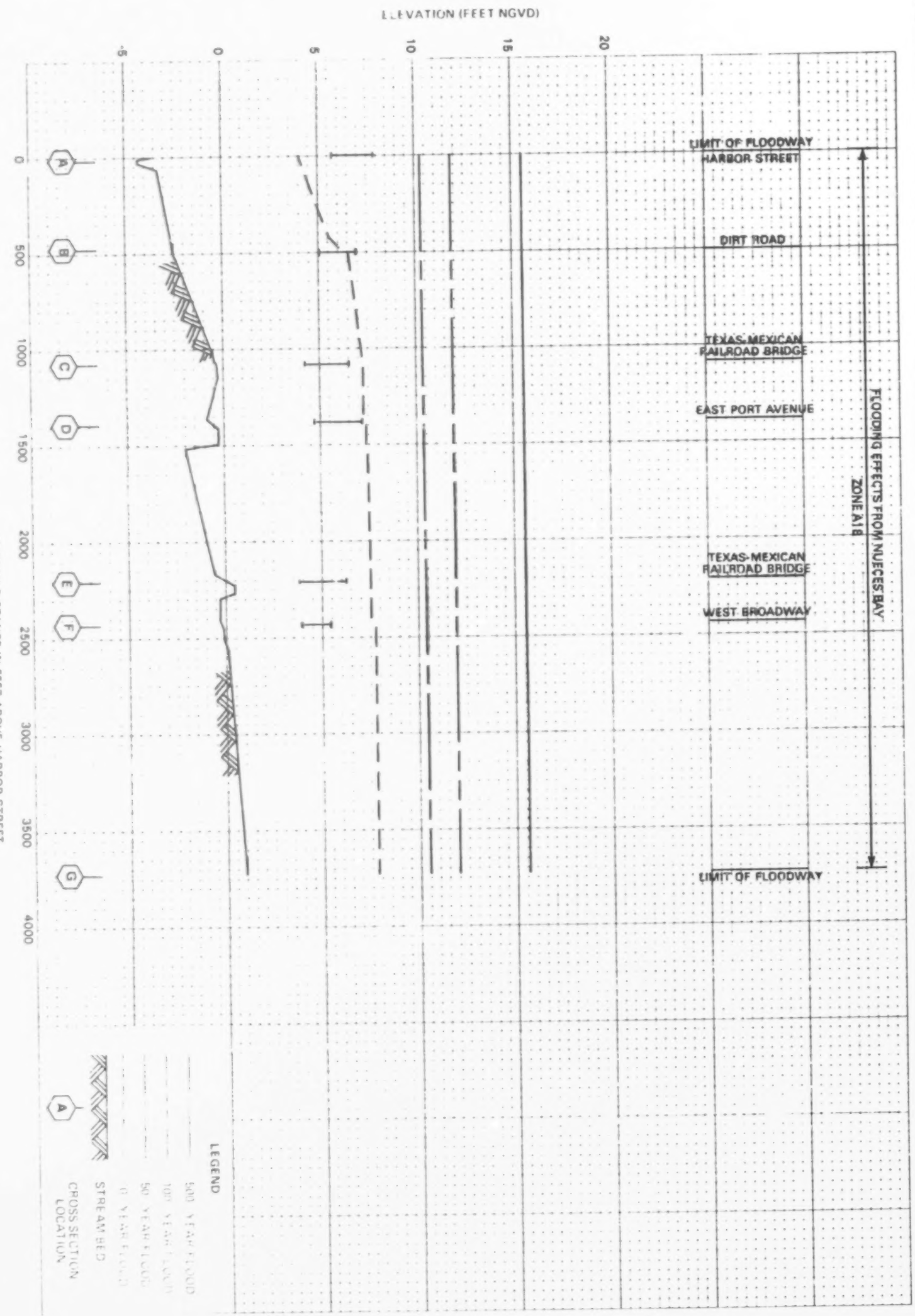
05P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX
(NUECES AND KLEBERG COS.)

FLOOD PROFILES

DRAINAGE CREEK



06P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF CORPUS CHRISTI, TX (NUECES AND KLEBERG COS.)	FLOOD PROFILES TURNING BASIN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

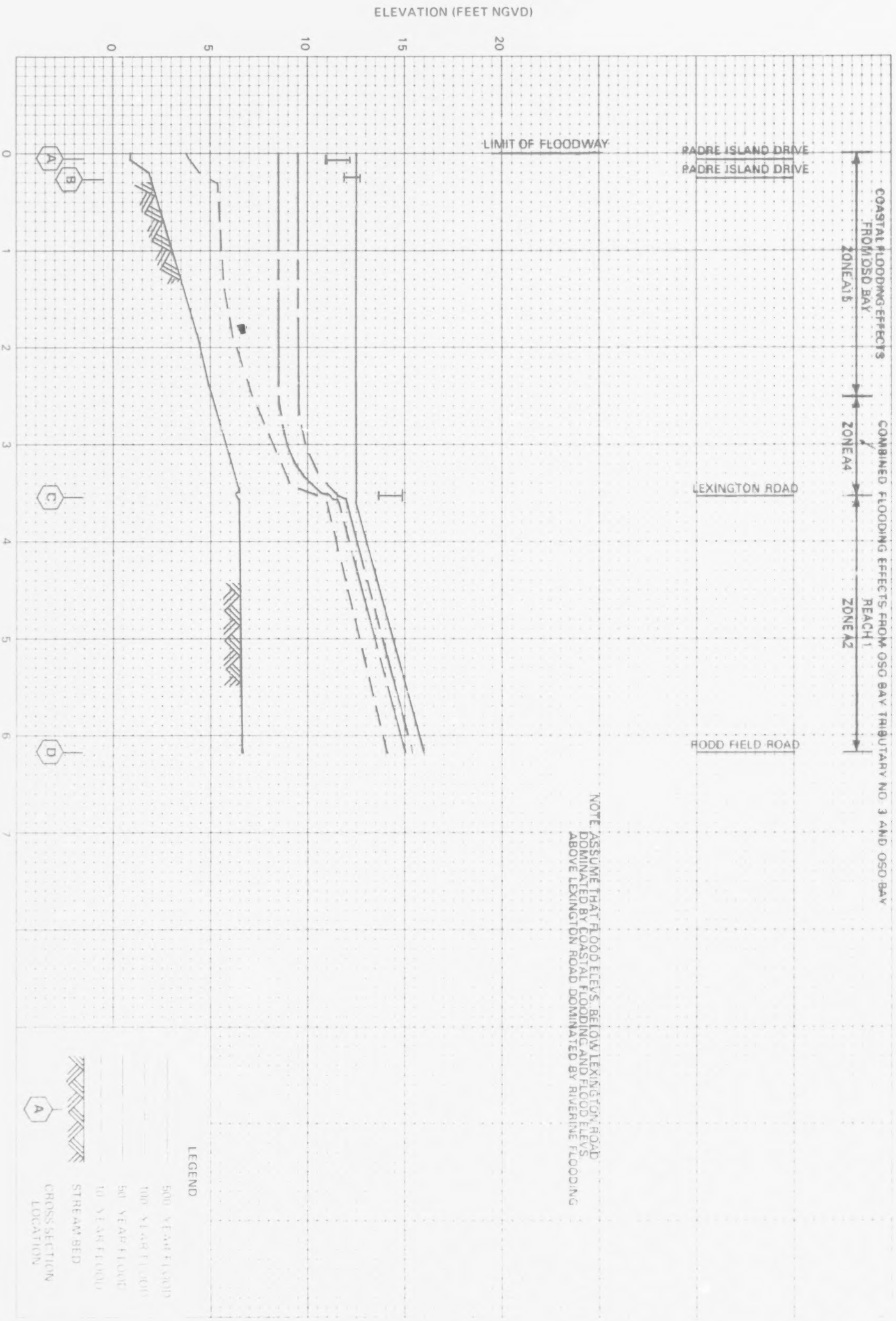
(NUECES AND KLEBERG COS.)

FLOOD PROFILES

OSO BAY TRIBUTARY NO. 2

07P

08P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF CORPUS CHRISTI, TX (NUECES AND KLEBERG COS.)	FLOOD PROFILES OSO BAY TRIBUTARY NO. 2



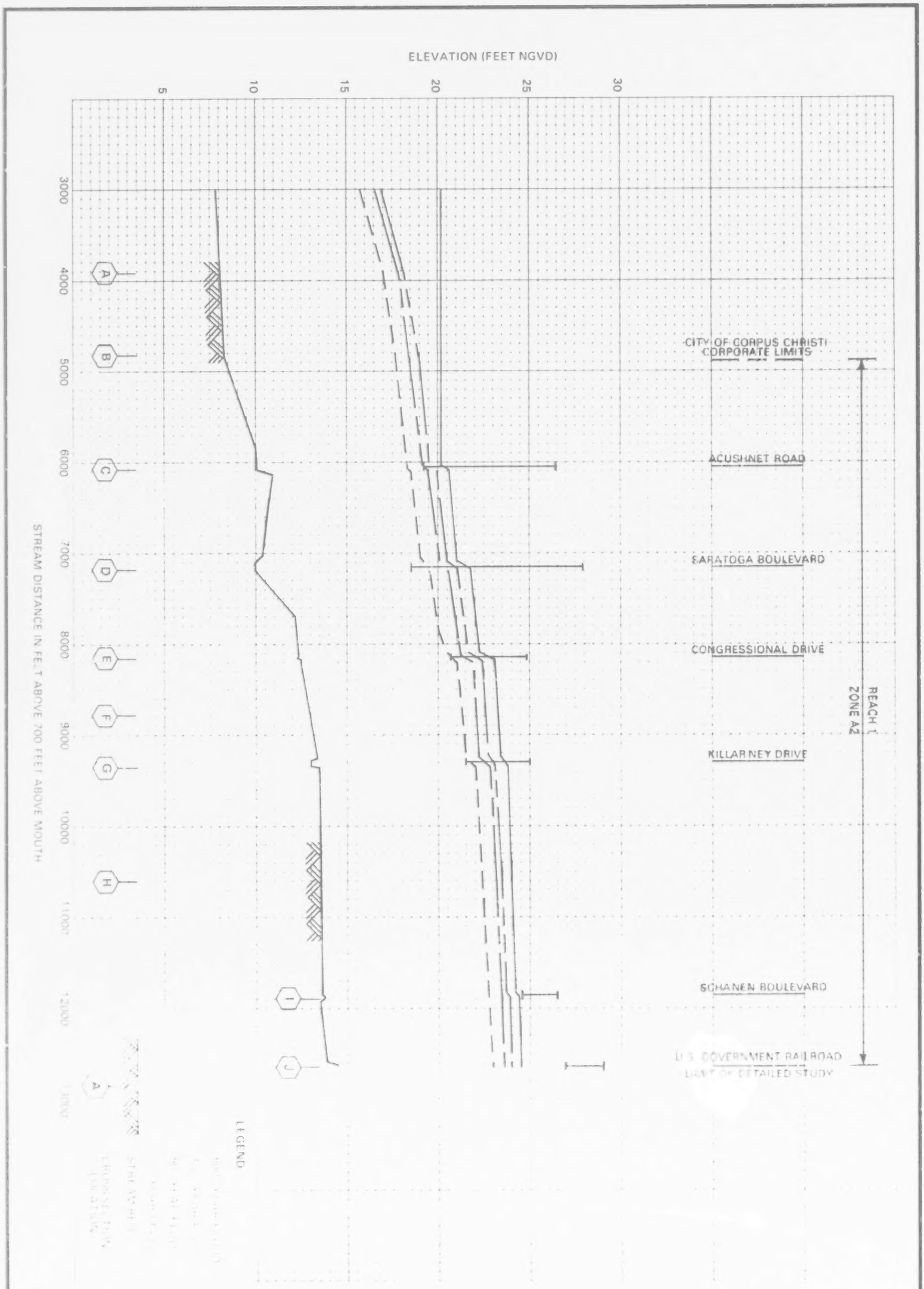
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX
(NUECES AND KLEBERG COS.)

FLOOD PROFILES

OSO BAY TRIBUTARY NO. 3

09P



53

10P

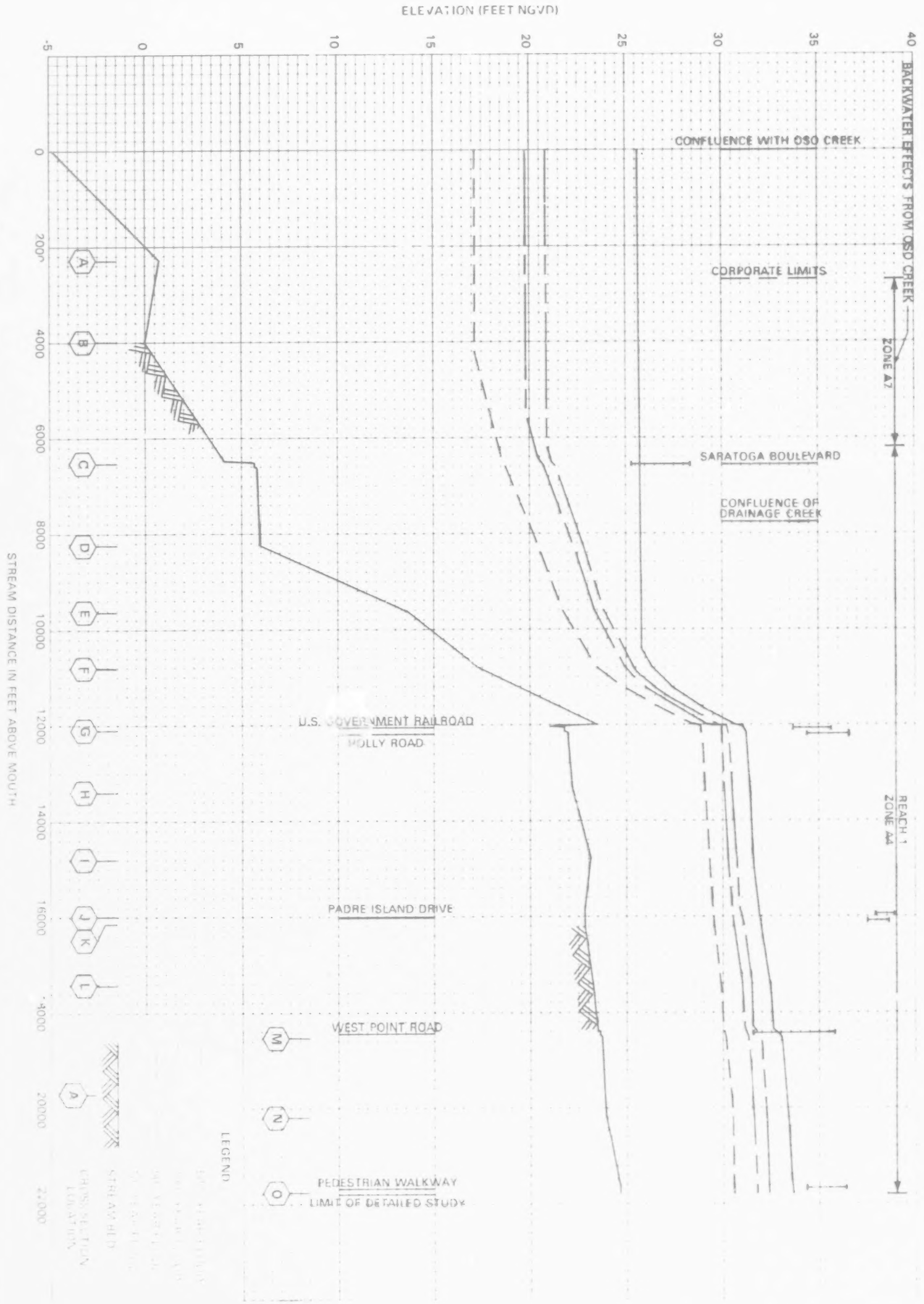
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 6



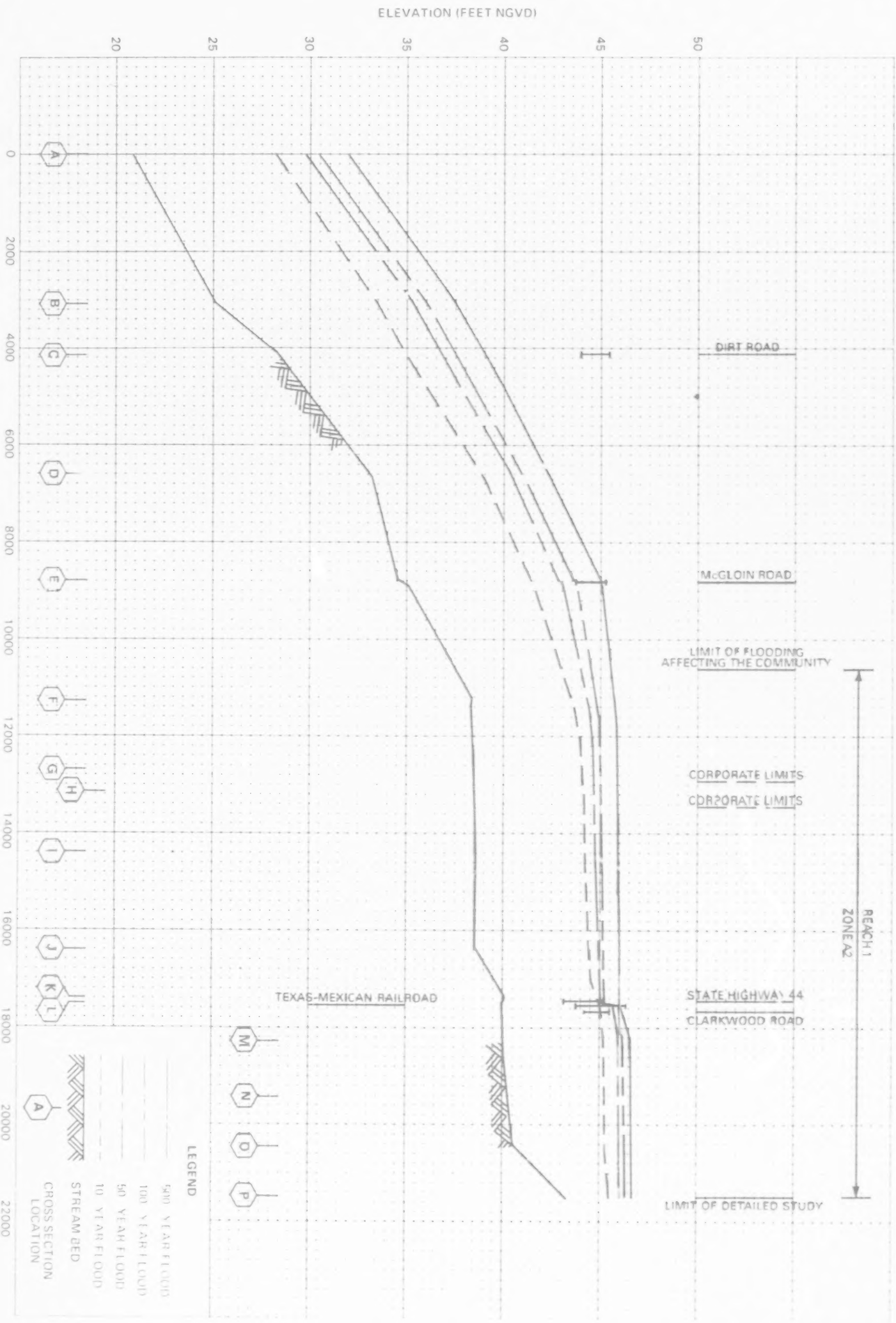
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX.
(NUECES AND KLEBERG COS.)

FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 10

11P



55

12P

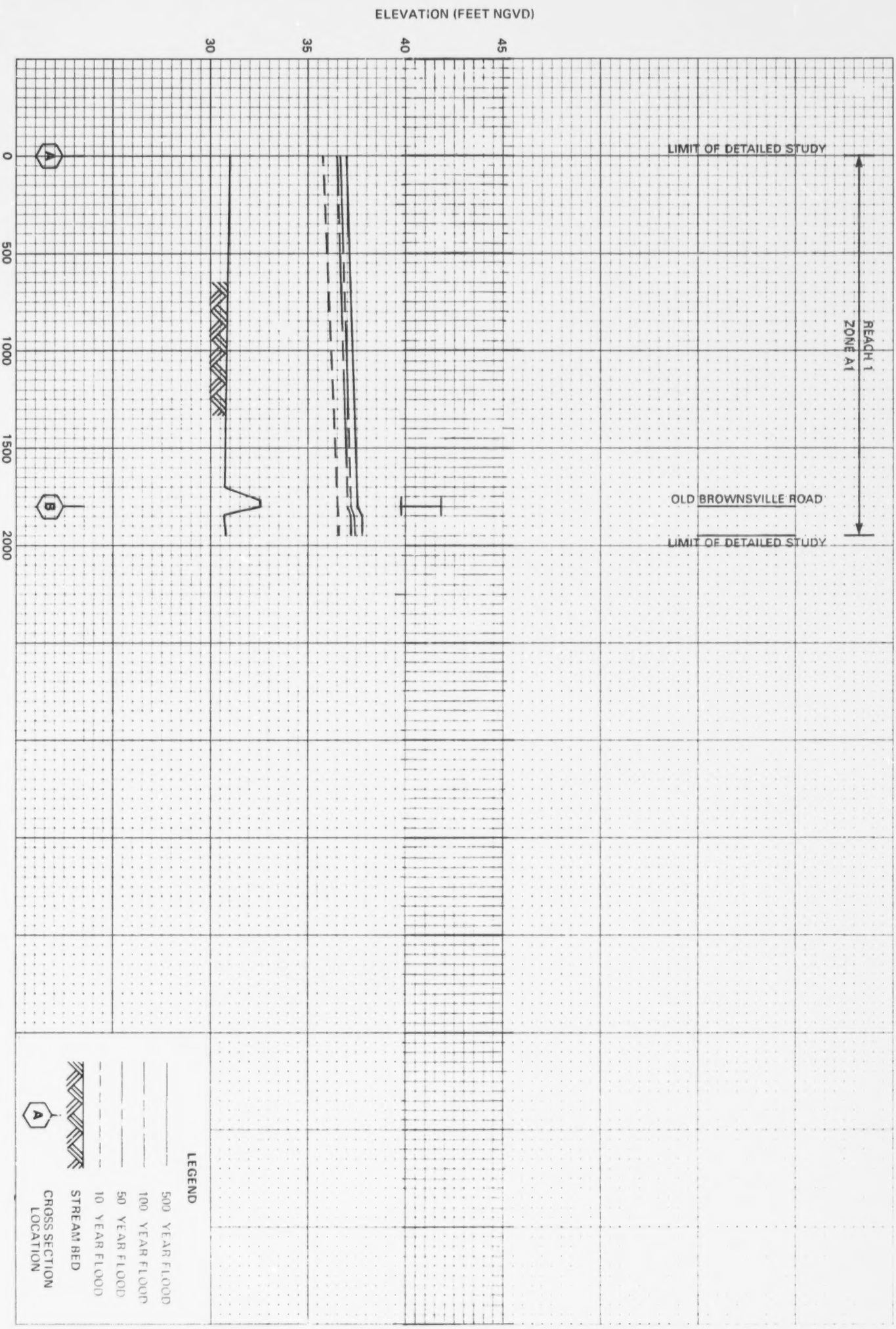
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

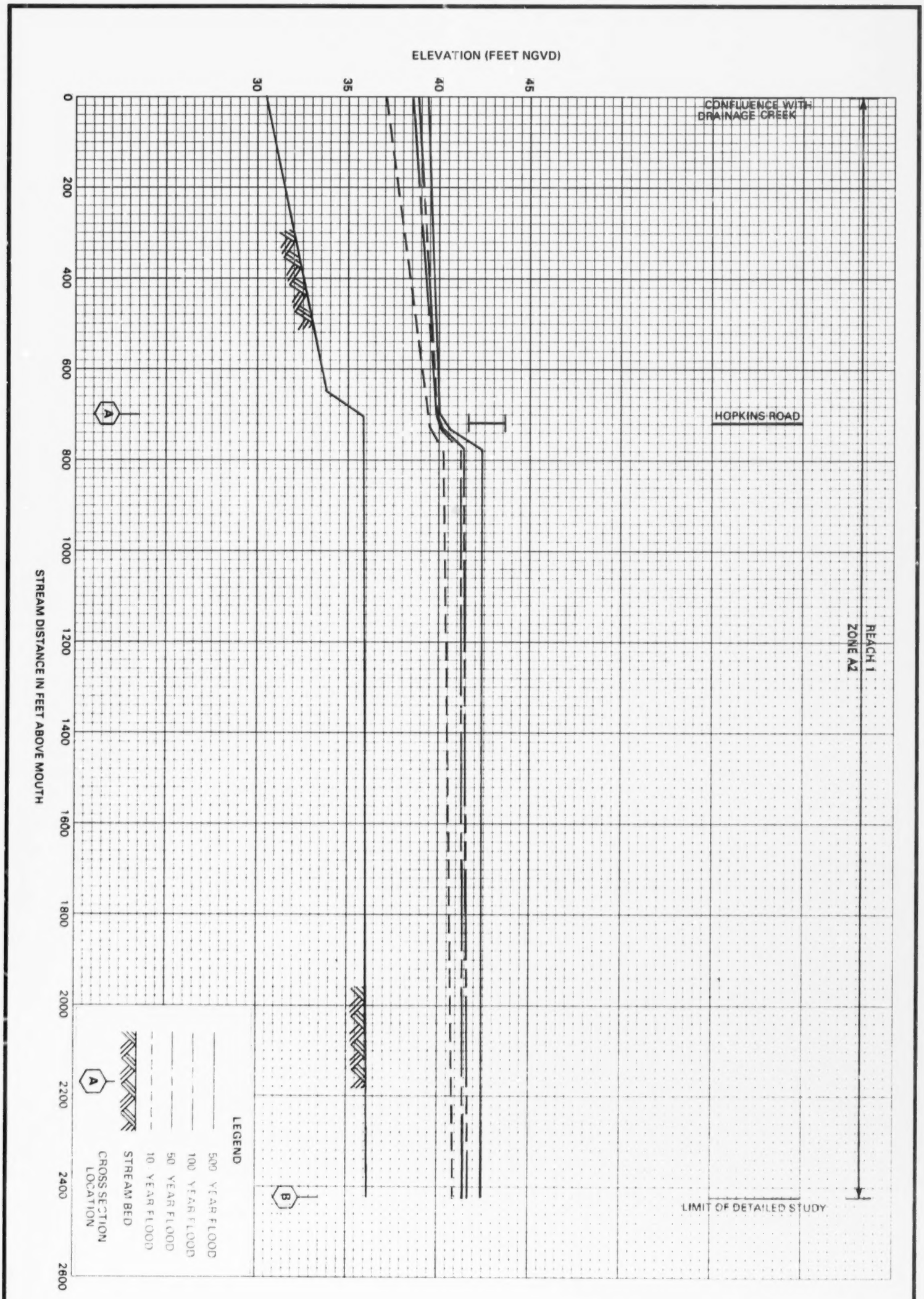
(NUECES AND KLEBERG COS.)

FLOOD PROFILES

OSO CREEK TRIBUTARY NO. 14

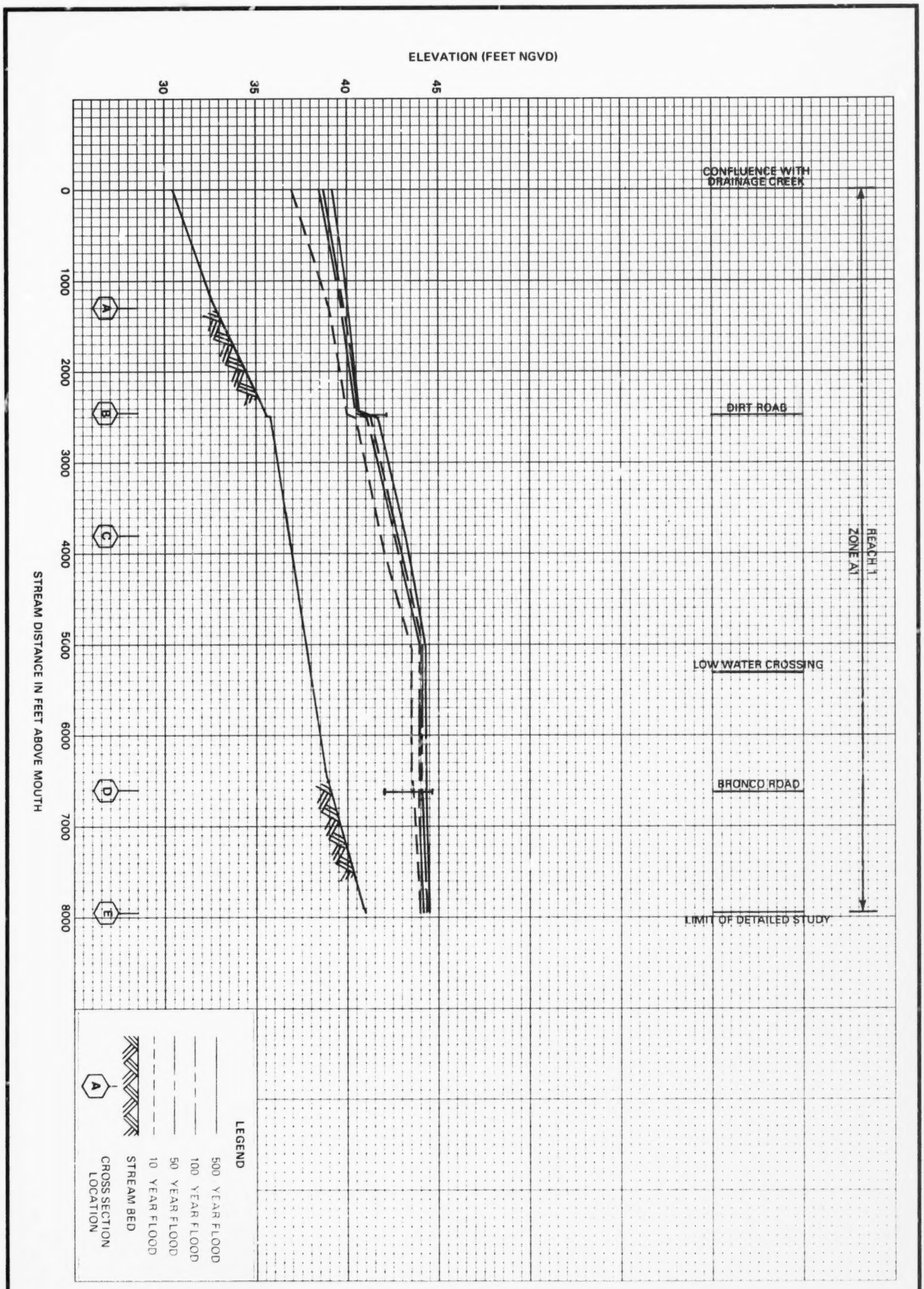


13P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF CORPUS CHRISTI, TX (NUECES AND KLEBERG COS.)	FLOOD PROFILES NAVIGATION BOULEVARD DRAINAGE DITCH



57

14P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF CORPUS CHRISTI, TX** (NUECES AND KLEBERG COS.)	**FLOOD PROFILES** **STATE HIGHWAY 44 EAST DRAINAGE DITCH**



15P

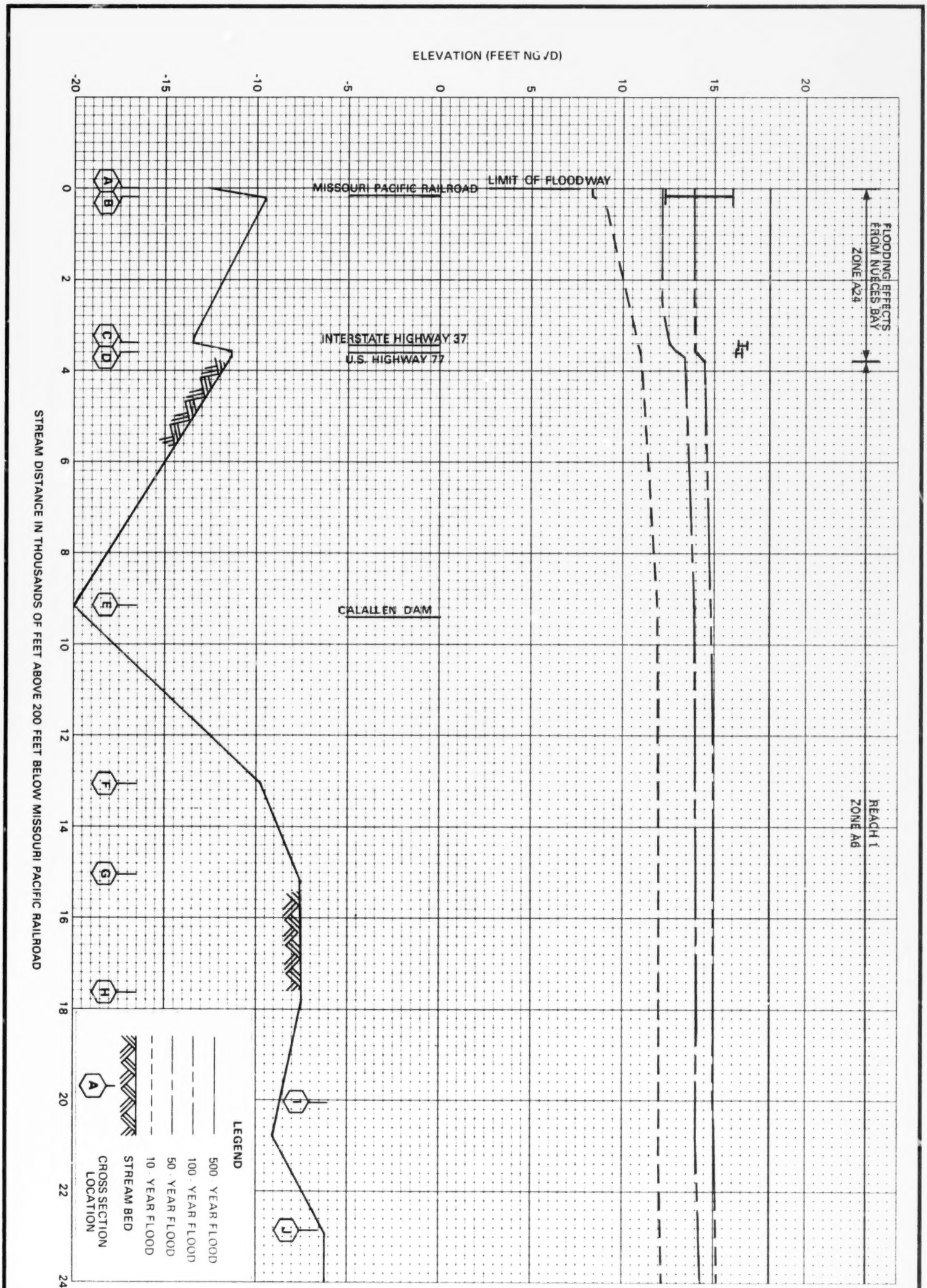
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD PROFILES

STATE HIGHWAY 44 WEST DRAINAGE DITCH



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16P

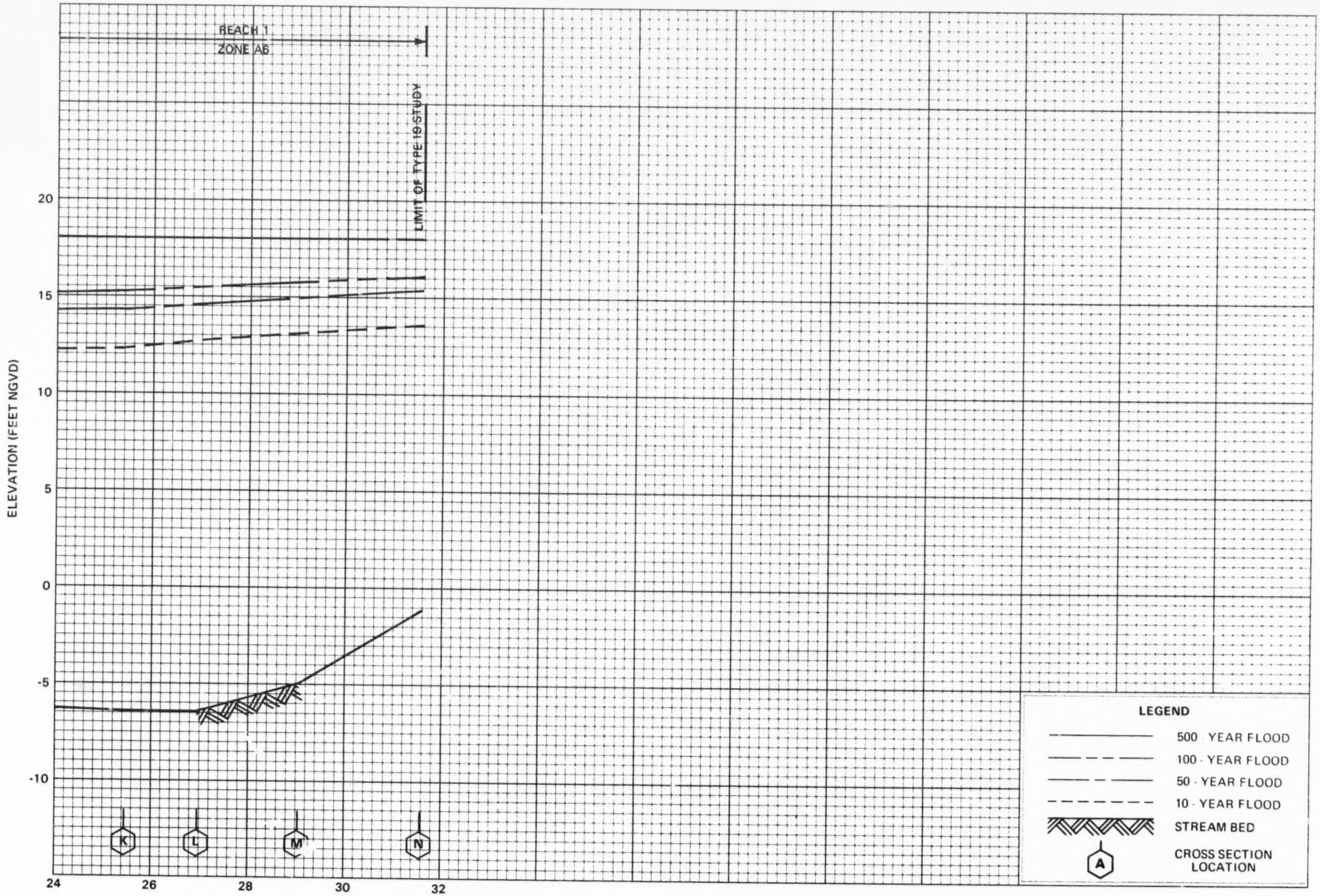
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

FLOOD PROFILES

NUECES RIVER



FLOOD PROFILES

NUECES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORPUS CHRISTI, TX

(NUECES AND KLEBERG COS.)

17P